THE GENERA OF COMMELINACEAE IN THE SOUTHEASTERN UNITED STATES[1]

GORDON C. TUCKER[2]

COMMELINACEAE R. Brown, Prodr. 268. 1810,
"Commelineae," nom. cons.

(SPIDERWORT FAMILY)

Perennial or annual, mucilaginous herbs [twiners]. Roots fibrous or thickened. Stems soft. Leaves several, cauline or basal; sheaths closed; blades flat to V-shaped, the margins often with short prickles; vernation involute or supervolute. Inflorescences 1 to several, variously thyrsiform or cymose, terminal or axillary, sometimes subtended by spathes. Pedicels slender. Flowers perfect [imperfect], actinomorphic or zygomorphic, unscented [strongly or weakly scented]. Sepals 3, narrowly oblong to ovate, free. Petals 3, oblong to broadly ovate, sometimes clawed, free or connate. Stamens [1 or] 2–4 or 6; staminodia, if present, 2–4; filaments glabrous or hairy; anthers narrowly oblong, dorsifixed, tetrasporangiate, introrse [extrorse or poricidal]; pollen ovoid, monosulcate [trisulcate], binucleate [trinucleate]. Ovary syncarpous, [2- or] 3-locular; ovules

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1–3 per locule, orthotropous. Fruit a loculicidal capsule [berry or nutlet]. Seeds small, circular to oblong, flattened laterally [winged], often reticulately pitted [arillate]; endosperm abundant; embryo small, broadly capitate, beneath a disclike callosity on seed coat. TYPE GENUS: *Commelina* L.

A medium-sized family of 40–50 genera and 500–600 species. The largest genus is *Commelina,* with about 230 species. The family is pantropic and warm temperate, with centers of diversity in Mesoamerica, tropical Africa, and southern India. There is general agreement that the family most closely related to the Commelinaceae is the Mayacaceae (see Thieret, Tomlinson). No consensus exists, however, concerning suprageneric classification in the family: although two tribes have commonly been recognized, their circumscriptions have varied. The system of Faden (1985) is followed here. The Tradescantieae C. B. Clarke are characterized by stomata with four subsidiary cells (except two in *Callisia* sect. CUTHBERTIA (Small) Hunt); inflorescences consisting of basally fused pairs of cincinni or thyrses of cincinni subtended by large to small leaflike or modified spathes; generally actinomorphic and most often self-incompatible flowers; a gynoecium of three locules, each with two ovules; and six stamens, all fertile. This chiefly New World tribe is represented in the United States by three genera, all with species present in the Southeast: *Tradescantia* L. (including *Zebrina* Schnizl., *Setcreasea* K. Schum. & Sydow, and *Rhoeo* Walp.), *Callisia* Loefl. (including *Cuthbertia* Small and *Tradescantella* Small), and *Gibasis* Raf.

Representatives of tribe Commelineae have stomata with six subsidiary cells (Tomlinson, 1969). Flowers are often zygomorphic and are generally self-compatible. There are usually only three stamens and three (four) or no staminodia. The Commelineae are most diverse in the Old World tropics. Two genera, *Commelina* and *Murdannia* Royle, are represented in the United States, both in the Southeast.

Clarke (1881) recognized three tribes: the Pollieae C. B. Clarke (fruits indehiscent), the Tradescantieae (stamens 5 or 6, staminodia lacking; fruits capsular), and the Commelineae (stamens 2 or 3, staminodia lacking or 1–4; fruits capsular). Brückner (1930) followed Clarke but treated the last two tribes as subfamilies (with the Pollieae included in the Tradescantioideae Brückner). Pichon, in an apparent frenzy of taxonomic splitting, recognized ten tribes and accorded familial status to the Australian genus *Cartonema* R. Br. Brenan (1966) recognized 15 groups to which he assigned no rank, although several of them correspond to tribes recognized by Pichon. Brenan's insightful (but informal) classification pointed out morphological similarities among groups of genera; these have later been confirmed by anatomical or cytological studies. Hutchinson recognized no suprageneric ranks in the family, noting that relationships of genera were poorly understood and largely defined by "Linnean" characteristics such as stamen number. Woodson emphasized the importance of inflorescence characters for classification. He noted that some genera placed by Brückner (1930) in the supposedly "zygomorphic" subfam. Commelinoideae actually had actinomorphic flowers. Faden (1985) recognized two subfamilies, the Cartonematoideae[3] and the Commelinoideae, the latter with two

tribes, the Tradescantieae and the Commelineae, a classification followed here. Recent diverse studies (discussed below) have provided eclectic information on the distribution of characters in the family. So far, these data have not been brought together and used for a synthetic classification based on evolutionary relationships.

In the present account, broad generic concepts are followed. This seems prudent both in view of the difficulty in defining genera and because of the diverse circumscriptions given to many of them (e.g., *Callisia* and *Tradescantia*). The generic classification of the Tradescantieae following Hunt is accepted here. Thus, *Tradescantia* is defined by its conspicuous, paired spathes and its fused cincinni. It is amply distinguished from *Tripogandra* Raf., which has zygomorphic flowers and dimorphic pollen (Handlos, 1975; Mattson). The various satellite genera near *Tradescantia,* such as *Rhoeo* and *Zebrina,* are treated as sections, as this seems a better indication that they differ less from sect. TRADESCANTIA than does *Tripogandra. Callisia* includes *Phyodina* Raf. and *Cuthbertia.* The genus as so circumscribed is defined by its reduced bracts and solitary cymes. *Gibasis* presents comparatively little problem in circumscription. It has paired (but unfused) cymes, with bracteoles and flowers arranged distichously on a conspicuous axis. The American species included in *Aneilema* R. Br. by recent authors (e.g., Fernald; Radford *et al.*) are placed here under *Murdannia* (*q.v.*).

Various workers agree that *Cartonema* is the most anomalous genus in the family, differing from all other Commelinaceae in its spiciform raceme, its lack of glandular microhairs and of raphides, and its poorly developed embryo and embryostega. Tomlinson (1969) has brought to light some additional anatomical differences (lack of transverse leaf veins and stem collenchyma, presence of radiate chlorenchyma in leaves) that support the unique status of *Cartonema.*

Triceratella Brenan, a genus endemic to southern Africa, has similarities both to *Cartonema* and to other genera of the family. Like *Cartonema, Triceratella* lacks glandular microhairs. However, it has raphide canals in the leaves, although the canals are adjacent to the veins, while in the remainder of the family they are not. Tomlinson (1969) suggested (but did not validly publish) subfamilial status for *Triceratella.*

Vessels are present in the vascular tissue of roots, stems, and leaves in all genera of the family that have been investigated except *Cartonema,* where they are present only in the roots (Tomlinson, 1969). The vessels have simple perforation plates. Sieve-tube plastids are of the "monocotyledonous type," in which there are several to many cuneate proteinaceous crystalloids. Although silica bodies are generally absent in the Commelinaceae, specialized epidermal cells containing silica are known from *Callisia* (including *Hadrodemas* Moore), *Coleotrype* C. B. Clarke, *Forrestia* A. Rich., *Gibasis,* and *Tripogandra.* Stomatal types have been surveyed by Tomlinson (1969). Both hexacytic and tetracytic stomata are known. (In the Mayacaceae they are paracytic.)

[3]**Cartonematoideae** (Pichon) R. Faden ex G. Tucker, stat. nov., based on Cartonemataceae Pichon, Not. Syst. Paris **12**: 219. 1946.

The family has received much attention from cytologists; the chromosomes are generally large and the meiotic material easy to work with. Chromosome numbers have been published for all but six genera, and numbers for one third of the species are in the literature. The family shows a wide range of variation in base number and other features of the karyotype. Base numbers vary from four to 20, including nearly every value between. The chromosomes of most karyotypes are generally alike in size. Species of the genus *Stanfieldiella* Brenan are a notable exception: their chromosomes are small, but there is typically one in the complement that is twice as long as the others. The species of *Stanfieldiella* have the smallest chromosomes (2–3 μm), and *Tradescantia virginiana* L. and its allies the largest (about 12–14 μm). Most genera have asymmetric karyotypes—i.e., most of the chromosomes have an acrocentric or telocentric kinetochore.

In this family a genus is usually characterized by a single base chromosome number and a particular karyotype. The lowest base chromosome number recorded (4, 5) is for species of *Gibasis* and the highest (20) for *Palisota* Reichenb. Each of the tribes (groups used by Brenan) shows considerable chromosomal diversity, which in some cases argues against their naturalness.

Polyploidy has been detected in several genera. Usually the taxa are tetraploids, although higher levels have been reported. Polyploidy is also known within species. Chromosomal change is a common feature of speciation in the family. Closely related species often differ in chromosome number or in karyotype.

The family is characterized by the presence of various flavonols and glucoflavones, often in quantity. Syringic acid and cyanidin are common. Sulfated phenolic acids have been detected in species of *Coleotrype, Commelina, Gibasis, Tradescantia,* and *Tripogandra.* Quercetin 3-glycoside is also widespread in the family but is most common in the genera of the Commelineae (Del Pero de Martínez). Steroidal saponins are known only from *Cyanotis* D. Don. Some 30 species have been examined for cyanogenesis, which is apparently rare (reported from *Commelina* and *Tinantia* Scheidw.). In *T. erecta* Schlecht. the cyanogenic glucoside is taxiphyllin (Tjon Sie Fat). The report of cyanogenesis in *Commelina benghalensis* L. by Juliano is considered doubtful (Tjon Sie Fat). Calcium-oxalate raphides in raphide canals are common; they are generally found in the members of the Commelinaceae but are absent in the Cartonematoideae and the Mayacaceae. Commelinin, a magnesium-containing metallo-anthocyanin, gives the blue color to the petals of *Commelina* species (Goto *et al.*; Hayashi).

Zantovska Stirton & Harborne investigated anthocyanins in 28 species representing seven genera (as recognized herein following Hunt, 1975; 1980; 1986a, b, d). All species were found to contain acylated glucosides, a rare class of anthocyanins not reported from any other monocotyledonous family. In *Cyanotis, Dichorisandra* Mikan, *Gibasis, Tradescantia* (including representatives of the segregate genera *Campelia* L. C. Rich., *Rhoeo,* and *Zebrina*), and *Tripogandra,* the most abundant anthocyanin was cyanidin 3,7,3′-triglucoside. In *Commelina* (seven species tested), however, the most abundant was *p*-coumaroyl-delphinidin 3,5-glucoside (commelinin). Thus there are two different

anthocyanins responsible for blue petal color in the family. It would be enlightening to learn whether other genera purportedly related to *Commelina* (e.g., *Murdannia, Aneilema*) also contain commelinin. It would also be interesting to identify the compounds responsible for the yellow petal color of such species as *C. africana* L.

Cleistogamous flowers are produced by certain species of *Commelina, Murdannia* (both Commelineae), and *Tinantia* (Tradescantieae).

There are six fertile stamens per flower in more than half the genera of the family (including the Cartonematoideae). Numerous genera have only three stamens, these alternating with or opposing in an adaxial-abaxial situation two to four staminodia. There is a single functional stamen in some species of *Callisia, Murdannia,* and *Pseudoparis* H. Perr. The filaments are hairy in many genera such as *Cartonema, Cyanotis, Tinantia,* and *Tradescantia* (including sect. RHOEO), and the filaments are fused in *Cochliostema* Lem. Anthers are tetrasporangiate (vs. bisporangiate in the Mayacaceae) and generally introrse. A few taxa are characterized by extrorse dehiscence, but *Dichorisandra* and *Porandra* Mikan (and members of the Mayacaceae) have poricidal anthers. The anther walls have girdle-type thickenings, and the tapetum is plasmodial. The pollen grains are always binucleate (seven genera studied by Owens) except in *Floscopa* Lour., where they are reported to be trinucleate (Davis). Poole & Hunt surveyed pollen morphology with scanning electron microscopy. All grains are monosulcate, except those of one species of *Tinantia,* which are trisulcate. Pollen dimensions are variable within and among genera. Four main types of ornamentation are encountered in the Tradescantieae and five in the Commelineae. The tectum tends to be insulate in species with actinomorphic flowers and spinulate, verrucate, or tuberculate in those with zygomorphic ones; in some species of *Callisia* and of *Gibasis* it is finely reticulate. All species of *Tradescantia* (including *Rhoeo* and *Zebrina*), the remaining species of *Gibasis,* and *Callisia* sects. HADRODEMAS (Moore) Hunt and CUTHBERTIA are characterized by the "*Tradescantia*-type" tectum (i.e., insulate, the insulae forming a cerebroid pattern). Species of *Commelina* and *Aneilema* have a perforate tectum bearing spinules; those of *Murdannia* have tubercles.

Species of *Tripogandra* are characterized by dimorphic pollen (Handlos) produced by two kinds of stamens: monosulcate, spheroidal, and fertile by the three anthers on short filaments; anasulcate, oblong, and infertile by the three on long filaments (Mattson). Both kinds of pollen have a granular-verrucate tectum interspersed with micropores (Poole & Hunt).

Placentation is axile in the Commelinaceae (vs. parietal in the Mayacaceae). The ovules of most genera are orthotropous, although they are hemianatropous in some and anatropous in *Cartonema* (orthotropous in the Mayacaceae). A parietal cell is generally present in the family but is known to be lacking in *Commelina* and *Cyanotis*. Megagametophyte development is of the Polygonum type in most genera but of the Allium type in *Tradescantia*. The ovary is syncarpous, and the style is three-branched. *Aneilema, Callisia, Commelina,* and *Tradescantia* have dry stigmas, while *Cyanotis, Gibasis, Thyrsanthemum* Pichon, and *Weldenia* Schultes f. have wet ones (Heslop-Harrison & Shivanna).

Endosperm formation is nuclear (several genera reported). Embryogeny con-

forms to the Asterad type. Endosperm is abundant and starchy. The mature embryo is capitate, broad, and achlorophyllous.

Fruits are capsules in most genera, except in *Athyrocarpus* Schlecht., *Pollia* Thunb. (both nutlets), and *Palisota* Reichenb. (berries). A few genera (*Amischotolype* Hassk., *Dichorisandra, Porandra*) have arillate seeds.

Pollination biology is little known, considering the size of the family. Faden (1983) studied isolating mechanisms in *Aneilema*. At a site in lowland Kenya where five species were growing in a small area, no hybrids were found. Some species pairs were separated by time of flower opening (morning vs. early afternoon), others by soil preference (well-drained sandy soils vs. waterlogged ones). Bees of several genera visited the flowers. The size of the flowers determined the bee that could gather pollen, thereby enforcing pollinator constancy. In certain species the lateral stamens were covered by the vernate petals, while in others the lateral and medial stamens were exposed simultaneously. Faden hypothesized that species in which the lateral stamens are covered longer would have a greater likelihood of outcrossing, since bees could gather less pollen from a flower with one or two anthers exposed than from one with three and would thus visit more flowers in a collecting trip.

Numerous species from several genera are worthy horticultural subjects. Several species of *Tradescantia* are cultivated in gardens in the United States and southern Canada. Trailing species of *Commelina* are used as ground covers. The most commonly cultivated taxa are *T. virginiana* and its hybrids with *T. subaspera* Ker or *T. ohiensis* Raf. ("*T.* ×*Andersoniana*," nom. inval.; see Hunt, 1984), all easily grown in well-drained garden soils. *Tradescantia Zebrina* Bosse (*Zebrina pendula* Schnizl.), wandering Jew (a name also applied to *T. fluminensis* Vell. and *T. albiflora* Kunth), is commonly grown as an indoor hanging-basket plant. The common cultivar is 'Purpusii'. All the above species are readily propagated by division or from seed. Some species of the African genus *Palisota* are occasionally grown indoors.

Murdannia nudiflora (L.) Brenan and several species of *Commelina* are serious weeds in numerous warm-temperate and tropical countries worldwide. *Commelina* species, especially *C. benghalensis*, are persistent and not easily controlled by herbicides (Wilson).

The tuberous roots of certain western African species of *Aneilema* contain abundant starch and are eaten (Augier), while those of *Commelina coelestis* Willd. (Sturtevant), *C. graminifolia* HBK., and *C. tuberosa* L. have been a source of food in Mexico. The young stems and leaves of *C. communis* L. (Sturtevant; Gibbons & Tucker), *C. diffusa* Burman f., and (according to Tanaka), *C. benghalensis* are edible as a cooked vegetable. The tender young shoots of *Tradescantia occidentalis* were eaten uncooked by Indians of the Great Plains (Yanovsky); the leaves and new shoots of *T. virginiana* L. can be similarly used (Fernald & Kinsey).

The fresh or dried leaves of *Tradescantia Zanonia* (L.) Sw. (Hegnauer) and *Commelina communis* (Preston) have been employed as a treatment to stop the flow of blood from surface wounds. A Mexican species (perhaps *C. virginica*) has similar effects and has also been reported to cure cancer of the stomach

(Herrera). *Commelina virginica* and *T. elongata* G. F. W. Meyer have been employed as diuretics in Latin America. The medically active principle in these species has apparently never been isolated.

REFERENCES:

AUGIER, J. Les glucides de quelques monocotylédones de l'ordre des Farinosae. Bull. Soc. Bot. France **103**: 251–253. 1956.

BAILEY, L. H., E. Z. BAILEY, & STAFF OF BAILEY HORTORIUM. Hortus third. xiv + 1290 pp. New York. 1976. [Commelinaceae, 301.]

BRENAN, J. P. M. *Triceratella,* a new genus of Commelinaceae from Rhodesia. Kirkia **1**: 14–19. 1961.

———. The classification of the Commelinaceae. Jour. Linn. Soc. Bot. **59**: 349–370. 1966. [Numerous illustrations.]

BRÜCKNER, G. Beiträge zur Anatomie, Morphologie, und Systematik der Commelinaceae. Bot. Jahrb. **61**(Beibl. 137): 1–70. *pls. i–vii.* 1926.

———. Zur speziellen Systematik der Commelinaceae. Notizbl. Bot. Gart. Berlin **10**: 55–61. 1927.

———. Commelinaceae. *In:* A. ENGLER, ed., Nat. Pflanzenfam. ed. 2. **15a**: 159–181. 1930.

CAIUS, J. The medicinal spiderworts of India. Jour. Bombay Nat. Hist. Soc. **39**: 361–365. 1937.

CELARIER, R. P. Cytology of the Tradescantieae (Commelinaceae). Bull. Torrey Bot. Club **82**: 30–38. 1955.

CHANT, S. R. Commelinaceae. Pp. 279–281 *in* V. H. HEYWOOD, ed., Flowering plants of the world. New York. 1978.

CHEADLE, V. I., & H. KOSAKI. Occurrence and specialization of vessels in Commelinales. Phytomorphology **30**: 98–117. 1980.

CLARKE, C. B. Commelinaceae. *In:* A. & C. DE CANDOLLE, eds., Monogr. Phanerog. 3: 113–324. 1881.

CLEWELL, A. F. Guide to the vascular plants of the Florida Panhandle. viii + 605 pp. Tallahassee. 1985. [Commelinaceae, 71, 72.]

DAVIS, G. L. Systematic embryology of the angiosperms. vii + 528 pp. New York, London, and Sydney. 1966. [Commelinaceae, 87, 88.]

DEL PERO DE MARTÍNEZ, M. A. Los flavanoides de las Commelinaceae y su interpretación con otras familias de Monocotiledóneas. (Abstract.) Resumenes Jornadas Argent. Bot. **18**: 72, 73. 1981.

FADEN, R. B. A biosystematic study of the genus *Aneilema* R. Br. (Commelinaceae). xii + 626 pp. Unpubl. Ph.D. dissertation, Washington Univ., St. Louis. 1975.

———. *Pollia* Thunb. (Commelinaceae): the first generic record from the New World. Ann. Missouri Bot. Gard. **65**: 676–680. 1978.

———. Isolating mechanisms among five sympatric species of *Aneilema* R. Br. (Commelinaceae) in Kenya. Bothalia **14**: 997–1002. 1983.

———. Commelinaceae. Pp. 381–387 *in* R. M. T. DAHLGREN, H. T. CLIFFORD, & P. F. YEO. The families of the monocotyledons. Berlin, Heidelberg, New York, and Tokyo. 1985.

———. Comparative vegetative and reproductive features of forest and non-forest Commelinaceae. (Abstract.) Am. Jour. Bot. **73**: 763. 1986.

——— & D. R. HUNT. Reunion of *Phaeosphaerion* and *Commelinopsis* with *Commelina* (Commelinaceae). Ann. Missouri Bot. Gard. **74**: 121, 122. 1987.

——— & Y. SUDA. Cytotaxonomy of Commelinaceae: chromosome numbers of some African and Asiatic species. Bot. Jour. Linn. Soc. **81**: 301–325. 1980.

FERNALD, M. L. Gray's manual of botany. ed. 8. lxiv + 1632 pp. New York. 1950. [Commelinaceae, 392–395.]

——— & A. C. KINSEY. Edible wild plants of eastern North America. (Revised by R. C. ROLLINS. 1958.) xii + 452 pp. New York and Evanston, Illinois. 1943. [Commelinaceae, 122–124.]

GIBBONS, E. T., & G. C. TUCKER. Euell Gibbons' handbook of edible wild plants. [xi +] 319 pp. Virginia Beach, Virginia. 1979.

GOTO, T., T. HOSHINO, & S. TAKASE. A proposed structure of commelinin, a sky-blue anthocyanin complex obtained from the flower petals of *Commelina*. Tetrahedron Lett. **31**: 2905–2908. 1979.

GUERVIN, C., & C. LE COQ. Karyology of Commelinaceae; application to several problems relative to their evolution. Rev. Cytol. Biol. Veg. **29**: 267–328. 1966.

HAMANN, U. Character stability and relationships of Farinosae; a contribution to the system of monocotyledons. Willdenowia **2**: 639–768. 1961.

HANDLOS, W. L. Cytological investigations of some Commelinaceae from Mexico. Baileya **17**: 6–33. 1970.

———. The taxonomy of *Tripogandra* (Commelinaceae). Rhodora **77**: 213–333. 1975.

HAYASHI, K. Further experiment on the structure of commelinin—an approach to the problem of flower color variation. (Abstract.) XI Int. Bot. Congr. Abstr. 87. 1969.

HEGNAUER, R. Chemotaxonomie der Pflanzen. Band 2. Monocotyledoneae. 540 pp. Basel and Stuttgart. 1963. [Commelinaceae, 117–121.]

HERD, Y., & D. J. BEADLE. The site of self-incompatibility mechanism in *Tradescantia pallida*. Ann. Bot. II. **45**: 251–256. 1980.

HERRERA, A. Yerba de pollo. Am. Jour. Pharm. **69**: 290–294. 1897. [Mexican species of *Commelina*.]

HESLOP-HARRISON, Y., & K. R. SHIVANNA. The receptive surface of the angiosperm stigma. Ann. Bot. II. **41**: 1233–1258. 1977.

HOLLINSHEAD, M. H. Notes on the seedlings of *Commelina communis* L. Contr. Bot. Lab. Univ. Penn. **3**: 275–287. 1911.

HOLM, L., J. V. PANCHO, J. P. HERBERGER, & D. L. PLUCKNETT. A geographical atlas of world weeds. (Arabic, Chinese, English, French, German, Hindi, Indonesian, Japanese, Russian, and Spanish introductions.) xliv + 391 pp. New York and other cities. 1979.

HSU, K. S. Morphological study of Commelinaceae in Taiwan. 1. Inflorescence and flower. (In Chinese.) Quart. Jour. Chin. Forest. **5**(4): 87–95. 1972. [Illustrations.]

HUNT, D. R. The reunion of *Setcreasea* and *Separotheca* with *Tradescantia*. American Commelinaceae: I. Kew Bull. **30**: 443–458. 1975a. [Includes distribution map.]

———. Notes on *Gibasis*. American Commelinaceae: II. *Ibid.* 709–714. 1975b.

———. Further notes on *Gibasis*. American Commelinaceae: V. *Ibid.* **33**: 145, 146. 1978.

———. Sections and series in *Tradescantia*. American Commelinaceae: IX. *Ibid.* **35**: 437–442. 1980. [Broad generic concept.]

———. New taxa in Commelinaceae. Jour. Linn. Soc. Bot. **83**: 137–139. 1981.

———. Commelinaceae. Pp. 25–31 *in* S. M. WALTERS *et al.*, eds., The European garden flora. II. Monocotyledons (part II). Cambridge, England, and other cities. 1984. [*Callisia, Cochliostema, Commelina, Cyanotis, Dichorisandra, Geogenanthus, Gibasis, Siderasis, Tinantia, Tradescantia, Tripogandra, Weldenia.*]

———. A revision of *Gibasis* Rafin. Kew Bull. **41**: 107–129. 1986a. [Eleven species; illustrations of *G. geniculata, G. pellucida*.]

———. *Campelia, Rhoeo*, and *Zebrina* united with *Tradescantia*. American Commelinaceae: XIII. *Ibid.* **41**: 401–405. 1986b.

———. New names and a new species in *Tradescantia*. American Commelinaceae: XIV. *Ibid.* 406. 1986c. [*T. exaltata* (sect. MANDONIA), $2n = 12$, from Oaxaca, Mexico.]

———. Amplification of *Callisia* Loefl. American Commelinaceae: XV. *Ibid.* 407–412. 1986d.

HUTCHINSON, J. The families of flowering plants. ed. 3. xix + 968 pp. Oxford. 1973. [Commelinaceae, 692–700; Cartonemataceae, 700, 701.]

JONES, K., & C. JOPLING. Chromosomes and classification of Commelinaceae. Jour. Linn. Soc. Bot. **65:** 129–162. 1972.

JULIANO, J. B. Additional cyanophoric plants in the Makiling region. Philipp. Agr. **11:** 231, 232. 1923.

LEWIS, W. H. Meiotic chromosomes in African Commelinaceae. Sida **1:** 274–293. 1964.

LONG, R. W., & O. LAKELA. A flora of tropical Florida. xvii + 962 pp. Coral Gables, Florida. 1971. [Commelinaceae, 269–274.]

MARTIN, A. C. The comparative internal morphology of seeds. Am. Midl. Nat. **36:** 513–660. 1946. [Commelinaceae, 533, 535.]

MATTHEWS, J. F. A paper chromatographic study of North and South American species of the genus *Tradescantia*. Bot. Gaz. **127:** 74–78. 1966. [Supports removal of *Cuthbertia*.]

MATTSON, O. The development of dimorphic pollen in *Tripogandra* (Commelinaceae). Pp. 163–183 *in* I. K. FERGUSON & J. MULLER, eds., The evolutionary significance of the exine. London and New York. 1976.

MATUDA, E. Nuevas Commelinaceae de México y Guatemala. Anal. Inst. Biol. Méx. **26:** 59–77. 1955. [New species of *Callisia, Commelina, Setcreasea,* and *Tradescantia*.]

———. Las Commelináceas mexicanas. *Ibid.* **26:** 303–432. 1956. [Keys, descriptions, illustrations.]

MAYER, A. M., & A. POLJAKOFF-MAYBER. The germination of seeds. ed. 3. ix + 211 pp. Oxford and other cities. 1982. [*Tradescantia virginica* (*sic*), 9; illustration of seedling showing hypogeal germination.]

MITSUKURI, Y., & K. KOBAYASHI. Cytological studies in Commelinaceae. IV. Chromosome numbers and karyotypes of some species. (In Japanese; English summary.) Kromosomo **51/52:** 1734–1739. 1962.

MORTON, J. K. The Commelinaceae of West Africa: a biosystematic survey. Jour. Linn. Soc. Bot. **60:** 167–221. 1967.

MURTHY, K. L. Gametogenesis and embryogeny in some Commelinaceae. Jour. Indian Bot. Soc. **17:** 101–116. 1938.

OWENS, S. J. Self-incompatibility in the Commelinaceae. Ann. Bot. II. **47:** 567–581. 1981.

——— & N. J. HORSFIELD. A light and electron microscopic study of stigmas in *Aneilema* and *Commelina* species (Commelinaceae). Protoplasma **112:** 26–36. 1982. [Illustrations.]

——— & F. M. KIMMINS. Stigma morphology in Commelinaceae. Ann. Bot. II. **47:** 771–783. 1981. [*Callisia, Commelina, Gibasis, Tradescantia*.]

PARKS, M. Embryo sac development and cleistogamy in *Commelinantia Pringlei*. Bull. Torrey Bot. Club **62:** 91–104. *pls. 7, 8.* 1935.

PICHON, M. Sur les Commelinacées. Not. Syst. Paris **12:** 217–242. 1946. [Keys to tribes and genera; detailed discussion of generic limits; three new genera from New World.]

POOLE, M. M., & D. R. HUNT. Pollen morphology and the taxonomy of the Commelinaceae: an exploratory survey. American Commelinaceae: VIII. Kew Bull. **34:** 639–660. 1980. [Many illustrations.]

PRESTON, G. K. A species of *Commelina*. Am. Jour. Pharm. **70:** 321–335. 1898. [Probably *C. communis*; illustrations.]

RADFORD, A. E., H. E. AHLES, & C. R. BELL. Manual of the vascular flora of the Carolinas. lxi + 1183 pp. Chapel Hill, North Carolina. 1968. [Commelinaceae, 268–271.]

RAGHAVAN, R. S., & S. R. ROLLA. Cytological observations on Indian species of Commelinaceae. Curr. Sci. Bangalore **30:** 310, 311. 1961.

RAO, R. S., R. S. RAGHAVAN, & R. V. KAMMATHY. Biosystematic studies on Indian Commelinaceae—chromosome pattern and evolutionary trends. Bull. Bot. Surv. India **12:** 242–254. 1970.

ROHWEDER, O. Die Farinosae in der Vegetation von El Salvador. Abh. Geb. Auslandsk. **61**: 98–178. 1956.

———. Beiträge zur Blütenmorphologie und -anatomie der Commelinaceen mit Anmerkungen zur Begrenzung und Gliederung der Familie. Ber. Schweiz. Bot. Ges. **79:** 199–220. 1969.

ROWLEY, J. R. The fine structure of the pollen wall in the Commelinaceae. Grana Palynol. **2**: 3–31. 1959.

——— & A. O. DAHL. The aperture of the pollen grain in *Commelinantia*. Pollen Spores **4**: 221–232. 1962.

SHARMA, A. K., & A. SHARMA. Further investigations on cytology of members of Commelinaceae with special reference to the role of polyploidy and the origin of ecotypes. Jour. Genet. **56:** 63–84. 1958.

STEBBINS, G. L., & S. K. JAIN. Developmental studies of cell differentiation in the epidermis of monocotyledons. I. *Allium, Rhoeo,* and *Commelina*. Develop. Biol. **2:** 409–426. 1960.

STURTEVANT, E. L. Sturtevant's edible plants of the world. (U. P. HEDRICK, ed.) vii + 686 pp. Albany, New York. 1919.

TANAKA, T. Tanaka's cyclopedia of edible plants of the world. [viii +] 924 pp. Tokyo. 1976.

THARP, B. C. *Commelinantia,* a new genus of the Commelinaceae. Bull. Torrey Bot. Club **49:** 269–275. *pls. 10, 11.* 1922.

———. *Commelinantia* (Commelinaceae): an evaluation of its generic status. *Ibid.* **83:** 107–112. 1956.

THIERET, J. T. The Mayacaceae in the southeastern United States. Jour. Arnold Arb. **56:** 248–255. 1975. [Also useful at species level.]

TIWARI, S. C., & B. E. S. GUNNING. Cytoskeleton cell surface and the development of invasive plasmodial tapetum in *Tradescantia virginiana*. Protoplasma **133:** 89–99. 1986a.

——— & ———. An ultrastructural cytochemical and immunofluorescence study of post-meiotic development of plasmodial tapetum in *Tradescantia virginiana* and its relevance to the pathway of sporopollenin secretion. *Ibid.* 100–114. 1986b.

——— & ———. Colchicine inhibits plasmodium formation and disrupts pathways of sporopollenin secretion in the anther tapetum of *Tradescantia virginiana*. *Ibid.* 115–128. 1986c.

TJON SIE FAT, L. A. Contribution to the knowledge of cyanogenesis in angiosperms. 8th communication. Cyanogenesis in Commelinaceae. Lloydia **41:** 571–573. 1978.

TOMLINSON, P. B. Anatomical data in the classification of the Commelinaceae. Jour. Linn. Soc. Bot. **59:** 371–395. 1966.

———. Commelinales–Zingiberales. Vol. 3 *in* C. R. METCALFE, ed., Anatomy of the monocotyledons. Oxford. 1969.

TROLL, W. *Cochliostema odoratissimum* Lem.; structure and habits with comparative outlooks on other Commelinaceae. (In German.) Beitr. Biol. Pflanzen **36:** 325–389. 1961.

WALKER, N. E. Cuticular comparison of genera of Commelinaceae. x + 129 pp. Unpubl. Ph.D. dissertation, Univ. Missouri, Columbia. 1974.

WILSON, A. K. Commelinaceae—a review of the distribution, biology, and control of the important weeds belonging to this family. Trop. Pest Managem. **27:** 405–418. 1981. [*Commelina benghalensis, C. diffusa, Murdannia nudiflora*; an important paper.]

WOODSON, R. E. Commentary on the North American genera of Commelinaceae. Ann. Missouri Bot. Gard. **29:** 141–154. 1942.

WUNDERLIN, R. P. Guide to the vascular plants of central Florida. [vi +] 472 pp. Tampa and other cities. 1982. [Commelinaceae, 128–131.]

YANOVSKY, E. Food plants of the North American Indians. 87 pp. Washington, D. C. 1936.

ZANTOVSKA STIRTON, J., & J. B. HARBORNE. Two distinctive anthocyanin patterns in the Commelinaceae. Biochem. Syst. Ecol. **8:** 285–287. 1980.

KEY TO THE GENERA OF COMMELINACEAE IN THE SOUTHEASTERN UNITED STATES

General characters: *fibrous-rooted or tuberous perennials (annuals) of open or disturbed places in full sun or light shade; stems and leaves soft, exuding mucilage when bruised; leaves basal or cauline, the sheaths closed, the blades linear, lanceolate, or broadly ellipsoid; inflorescences terminal or axillary and terminal, variously thyrsiform or cymose; flowers trimerous, perfect, actinomorphic or zygomorphic, sepals somewhat persistent, petals deliquescent, staminodia sometimes present; fruits more or less dehiscent 2- or 3-locular capsules; seeds oblong, ellipsoid, or triangular, often operculate, the seed coat pitted or roughened.*

A. Fertile stamens 6; filaments hairy (rarely glabrous).
  B. Inflorescences subtended by conspicuous, paired, leaflike spathes; anther connectives trapezoidal or triangular. ..... 1. *Tradescantia.*
  B. Inflorescences subtended by inconspicuous, paired or solitary, scarious or scalelike bract(s); anther connectives rectangular.
    C. Inflorescences dense, branches inconspicuous or absent; cymes solitary, without conspicuous axis. ..... 2. *Callisia.*
    C. Inflorescences open, branches conspicuous; cymes paired, with evident axis bearing 2-ranked orbiculate bracteoles. ..... 3. *Gibasis.*
A. Fertile stamens 3, staminodia 3; filaments glabrous.
  D. Spathes inconspicuous, scalelike; petals equal; stamens alternating with staminodia. ..... 4. *Murdannia.*
  D. Spathes conspicuous, leaflike; petals unequal; stamens below staminodia. ..... 5. *Commelina.*

SUPPLEMENTAL KEY EMPHASIZING VEGETATIVE FEATURES ESPECIALLY FOR USE WITH DRIED SPECIMENS[4]

A. Spathes paired, terminating stem. ..... 1. *Tradescantia.*
A. Spathes single, terminal or axillary.
  B. Inflorescences unbranched, closely enclosed by spathe.
    C. Spathes composed of sheath only. ..... 2. *Callisia.*
    C. Spathes with oblong to orbiculate blades, sheathless or nearly so. ..... 5. *Commelina.*
  B. Inflorescences branched (or if unbranched, the individual flowers pedicellate, not closely enclosed by spathe).
    D. Leaves asymmetric basally. ..... 3. *Gibasis.*
    D. Leaves symmetrical.
      E. Stems creeping. ..... 2. *Callisia.*
      E. Stems ascendent or erect.
        F. Leaves linear; stamens 6, staminodia lacking. ..... 2. *Callisia.*
        F. Leaves lanceolate; stamens 3, staminodia 3. ..... 4. *Murdannia.*

[4]Provided because floral characters distinguishing genera are not well preserved in dried specimens.

Tribe TRADESCANTIEAE Meisner ex C. B. Clarke in DC. Monogr. Phanerog. **3:** 120. 1881.

1. **Tradescantia** Linnaeus, Sp. Pl. **1:** 288. 1753; Gen. Pl. ed. 5. 139. 1754.

Perennial herbs. Roots fibrous, fleshy, sometimes tuberous. Stems branched or simple, erect to ascendent [creeping], sometimes much shorter than the leaf blades. Leaves several, both cauline and basal [basal only]; sheaths closed; blades broadly lanceolate to linear, sometimes slightly constricted just above sheath, apex acute to broadly rounded, membranaceous or succulent, narrowly to broadly canaliculate to flat, glabrous or pubescent [villous]. Inflorescences 1 to several, terminal [and/or axillary], cymose, forming tight umbels, subtended by 2 opposed, linear to broadly lanceolate, oblong, or suborbiculate spathes (sometimes the uppermost internode so short that the uppermost leaf appears to be a third spathe). Pedicels slender, erect or spreading, reflexed after anthesis, sometimes colored like petals. Flowers several, perfect, actinomorphic [slightly zygomorphic]. Sepals 3, equal [the uppermost larger], oblong, broadly rounded to acute. Petals 3, ovate [obovate], not clawed [clawed], distinct or sympetalous (fused along edges to each other) [or fused to edges of filaments]. Stamens 6, identical, all fertile; filaments densely hirsute, trichomes moniliform; anthers ellipsoid, the connective broad, trapezoidal to triangular, the anther sacs reniform, dehiscent longitudinally. Ovary ovoid to obovoid, glabrous or pubescent, 3-locular; ovules (1 or) 2 or 3 per locule, orthotropous. Fruit a capsule, more or less dehiscent [fleshy]. Seeds oblong to ovoid, laterally compressed, funicular scar linear, ½ to nearly equal the length of the seed. Base chromosome number 6. (Including *Cymbispatha* Pichon, *Setcreasea* K. Schum. & Sydow, *Rhoeo* Walpers, *Zebrina* Schnizl.; excluding *Cuthbertia* Small, *Tradescantella* Small.) TYPE SPECIES: *T. virginiana* L., the only species included by Linnaeus. (Named for John Tradescant, Jr., 1608–1662, British naturalist and gardener.)—SPIDERWORT.

A genus of about 60 species of the tropical and warm-temperate regions of the New World. Seventeen species occur in the Southeast, 13 of them native. This circumscription follows Hunt (1975a, 1980, 1986b), who recognized 12 sections, five of which are represented in our area. *Cuthbertia* is included in *Callisia* following Hunt.

The largest section, TRADESCANTIA, was divided by Hunt (1980) into four series. All the southeastern species of this section are in ser. TRADESCANTIA (ser. *Virginianae* Hunt, nom. superfl.), the members of which are perennials with short rhizomes, linear (leaflike) inflorescence spathes, and glandular-pubescent or glabrous pedicels and calyces.

All 17 species of ser. TRADESCANTIA are native to the United States, and 13 of these occur in the Southeast. The remainder are present in the Great Plains and the Southwest. The taxonomy of this series is rather well known, thanks to monographs by Anderson & Woodson and MacRoberts and the cytotaxonomic studies by Anderson & Sax and Anderson (1954). All are diploids or tetraploids with a similar karyotype (six or 12 large metacentric chromosomes),

and all are self-incompatible (Anderson & Sax; Anderson & Woodson; Owens). An account of the southeastern species of ser. TRADESCANTIA follows, then discussion of the three remaining series of sect. TRADESCANTIA.

Tradescantia subaspera Ker-Gawl. (*T. pilosa* Lehm.) is the tallest (30–100 cm) species of the series. The stems are conspicuously flexuose, and the broad leaf blades are lanceolate (not linear as in the other species of the series) and constricted to a subpetiolate base. It ranges from West Virginia to northern Illinois south to northwestern Florida, southern Alabama (Lelong), and southern Louisiana. The eastern populations have been distinguished as var. *montana* (Shuttlew. ex Small & Vail) Anderson & Woodson on the basis of their narrower leaves and sessile cymes. MacRoberts questioned the significance of the varieties because populations from Louisiana were intermediate between var. *montana* and the typical variety.

Tradescantia gigantea Rose ($2n = 12$; stems 30–60 cm tall; spathes saccate, velutinous; petals broadly obovate) is endemic to sandy soils of central and eastern Texas and three parishes of western Louisiana (MacRoberts).

Tradescantia virginiana L., the type species ("perhaps the most characteristic feature . . . is its turgid or inflated, delicately foliaceous, eglandular pubescent calyx"—Anderson & Woodson, 1935, p. 65), has long been cultivated both in the United States and in temperate regions worldwide. Its original range in North America can only be surmised. It is now known from southwestern Connecticut, southern Michigan, and western Wisconsin south to north-central North Carolina, northwestern Georgia, central Tennessee, and southeastern Missouri. Reports from the Gulf Coastal Plain are apparently based on misidentifications of *T. hirsuticaulis* (MacRoberts). Many cultivated plants identified as *T. virginiana* (especially outside North America) are actually "*T.* ×*Andersoniana*," the hybrids of *T. virginiana* and *T. ohiensis*.

Tradescantia Ernestiana Anderson & Woodson (basal and juvenile leaves linear, narrower than mature leaves and spathes; leaf blade broader than sheath, lacking basal constriction; roots long, slender, not fleshy), an Ozarkian endemic, occurs in southwestern Missouri, western Arkansas, and eastern Oklahoma. It is intermediate between *T. virginiana* and the Texas endemic *T. edwardsiana* Anderson & Woodson.

Tradescantia ohiensis Raf. (*T. canaliculata* Raf., *T. reflexa* Raf.) (roots slender, plants glaucous, upper leaves as long as the lower, the blades narrower than sheath, sepals glabrous) is a wide-ranging species found from Massachusetts, Michigan, Minnesota, and Nebraska south to southern Florida and southern Texas.

Tradescantia paludosa Anderson & Woodson (roots slender, fleshy; upper leaves shorter than lower; base of leaf blade not constricted; foliage not glaucous) is closely related to *T. ohiensis*. Its range is much more restricted (southern Alabama, southeastern Arkansas, eastern Louisiana, and perhaps also Mississippi). MacRoberts treated this as *T. ohiensis* var. *paludosa* (Anderson & Woodson) MacRoberts.

Tradescantia hirsutiflora Bush (stems spreading-pubescent; leaves broad, stiff; roots glabrous, not thickened; sepals glandular-pubescent or not), the most poorly understood species of ser. TRADESCANTIA (Anderson & Woodson), is

closely related to *T. virginiana*. It occurs from Georgia and western Florida to eastern Oklahoma and central Texas.

Tradescantia longipes Anderson & Woodson ($2n = 24$; stems 2–10 cm tall, leaves and spathes pilose, hairs eglandular), was described from southern Missouri and has recently been reported from northern Arkansas (Montgomery County; see Timme & Faden). It is limited to acidic soils in pine-oak forests. A close relative, *T. Tharpii* Anderson & Woodson, occurs only on calcareous soils derived from limestone or chert, in southwestern Missouri.

Tradescantia Reverchonii Bush, a close relative of *T. hirsutiflora*, can be distinguished by its densely tomentose roots. Such hairy roots are unique in the genus. The species is rare (southern Arkansas, Louisiana (Natchitoches and Caddo parishes), and westward to central Texas).

Tradescantia ozarkana Anderson & Woodson (leaf blades abruptly constricted just above the sheath, veinlets obvious in dried specimens, capsules 6–8 mm long) is perhaps not distinct from *T. edwardsiana* of central Texas. It is a rare species of western Arkansas, southwestern Missouri, and eastern Oklahoma.

Tradescantia occidentalis (Britton) Smyth (*T. virginiana* var. *occidentalis* Britton) is a species mainly of the Great Plains (Minnesota, Arkansas, and Louisiana west to southeastern Montana, southern Utah, and southern Arizona). The plants are glabrous, with the spathes leaflike, the sepals having some glandular hairs, and the hilum about half as long as the seed. *Tradescantia occidentalis* var. *melanthera* MacRoberts is distinguished only by its brown anther connectives (other North American species have yellow ones). Its more restricted range includes southern Arkansas, eastern Oklahoma, western Louisiana, and eastern Texas (MacRoberts).

Tradescantia roseolens Small is close to *T. occidentalis*, from which it differs in its longer hilum (nearly as long as the seed) and its allopatric distribution (western South Carolina and northern Georgia to southern Florida). The species grows in sandy soil in open woods. Its fresh flowers smell like tea roses (Anderson & Woodson).

Tradescantia hirsuticaulis Small (sepals petaloid, pinkish to purplish) has a peculiar distribution: Georgia, Alabama, Arkansas, and eastern Oklahoma. MacRoberts considered it a dubious species.

The three remaining series of sect. TRADESCANTIA comprise species of Mexico and the southwestern United States. Series SILLAMONTANAE Hunt (plants perennial, shortly rhizomatous, nontuberiferous, lanate) is restricted to northeastern Mexico and consists of two species, *T. sillamontana* Matuda (*T. pexata* H. E. Moore), $2n = 24$, and *T. Rozynskii* Matuda, $2n = 12, 24$, both of which are self-incompatible (Owens).

Series TUBEROSAE Hunt comprises about ten species of tuberous perennials of southern Arizona, southern New Mexico, and Mexico. All are self-incompatible. There are diploid, tetraploid, and hexaploid species (base number 6).

Members of series ORCHIDOPHYLLAE Hunt are subacaulescent tuberiferous perennials with glandular pedicels and calyces. There are two species, *Tradescantia orchidophylla* Hemsley and *T. Mirandae* Matuda, both $2n = 24$ and both of western Mexico. *Tradescantia Mirandae* is known to be self-incompatible.

The five remaining sections of *Tradescantia* are widely distributed in the warm regions of the New World, although none is represented by indigenous species in the Southeast.

The single species of sect. SEPAROTHECA (Waterfall) Hunt, *Tradescantia pygmaea* Hunt ($2n = 12$), is a tuberiferous perennial of the mountains of northwestern Mexico (Waterfall; Hunt, 1975a). Its anthers have broad connectives, and the edges of the filaments are adnate to the edges of the petals, forming a tube at least 1 mm long. The plants are self-incompatible.

Section MANDONIA Hunt (*Mandonia* Hasskarl, non Wedd.) comprises about ten species of tuberiferous perennials of Mexico, Guatemala, Bolivia, Brazil, and northern Argentina. There are both self-compatible and self-incompatible species. *Tradescantia crassifolia* Cav. ($2n = 12, 24$; self-incompatible) is an important weed in Mexico (Holm *et al.*).

In sect. PARASETCREASEA Hunt the petals and filaments of the three antesepalous stamens are fused along their edges to form a short tube (Hunt, 1980). There is but one species, *T. Andrieuxii*, $2n = 12, 24$, which is native to Mexico from Oaxaca to Chihuahua. Both self-compatible and self-incompatible plants have been reported (Owens).

Plants of sect. SETCREASEA (K. Schum. & Sydow) Hunt (*Setcreasea* K. Schum. & Sydow) are rhizomatous. The petals are fused basally to different heights in the five species, which occur in the southwestern United States and Mexico: *Tradescantia brevifolia* (Torrey) Rose, $2n = 24$, *T. Buckleyi* (Rose) I. M. Johnston, $2n = 24$, *T. hirta* Hunt, $2n = 24$, *T. leiandra* Torrey, $2n = 12$, and *T. pallida* (Rose) Hunt (*Setcreasea pallida* Rose), $2n = 12, 18, 24$. All are self-incompatible. *Tradescantia pallida* has recently been reported as an adventive in Pinellas County, Florida (Wunderlin *et al.*).

Section CYMBISPATHA (Pichon) Hunt (*Cymbispatha* Pichon) differs from sect. TRADESCANTIA in its base chromosome number ($x = 7$ vs. 6) and in having various acrocentric karyotypes derived by Robertsonian fusions. The uppermost sepal is larger than the others. This section is intermediate between sects. ZEBRINA (discussed below) and TRADESCANTIA (Hunt, 1980). It includes about seven species that occur from the mountains of western Mexico south to Brazil and Bolivia. There are both self-compatible and self-incompatible species, and *T. commelinoides* Schultes f., $2n = 14, 22, 23, 30$, includes both self-compatible and self-incompatible plants.

Section ZEBRINA (Schnizl.) Hunt (*Zebrina* Schnizl.) comprises two species of southern Mexico and northern Central America, *Tradescantia Schippii* Hunt and *T. Zebrina* Bosse (*Z. pendula* Schnizl.), $2n = 22, 23, 24, 41, 47$. The corolla is sympetalous to various degrees, and the hilum is punctiform. The karyotype is variable, a mixture of meta-, subtelo-, and telocentric chromosomes. The plants are self-compatible. *Zebrina* has sometimes been accorded generic status, but sympetaly varies in degree within the two species and has arisen elsewhere in the genus (e.g., sect. SETCREASEA). *Tradescantia Zebrina* is reported as a rare escape from cultivation in central Florida (Wunderlin).

Section RHOEO (Hance) Hunt (*Rhoeo* Hance) includes only *Tradescantia discolor* L'Hér. (*T. spathacea* Sw., *Rhoeo spathacea* (Sw.) Hance), boat-lily, Moses-in-the-bulrushes, three-men-in-a-boat, $2n = 12$, which is native to the Yucatan peninsula and Belize and naturalized in southern Florida. The plants

are succulent and bromeliadlike in habit. The spathes are broadly ovate, not linear as in sect. TRADESCANTIA, and there is only one ovule per locule. The karyotype, similar to that of the species of sect. TRADESCANTIA (Hunt, 1986b), consists of small, meta- to submetacentric chromosomes. Many translocations have occurred because the chromatids form rings or chains meiotic at metaphase (Lin & Paddock). Some plants are self-compatible, while others are not. The boat lily is widely cultivated in tropical regions and in greenhouses.

Three of the remaining four sections are monotypic. Section CAMPELIA (L. C. Rich.) Hunt (*Campelia* L. C. Rich.) has one species, *Tradescantia Zanonia* (L.) Sw., $2n = 16$. Its fleshy capsules and sepals are an adaptation to dispersal by birds. The axillary inflorescences perforate the subtending sheaths (Faden, 1985). The karyotype comprises 2 meta-, 2 submeta-, and 12 acrocentric chromosomes. The plants are self-incompatible.

In the one species of sect. COHOLOMIA Hunt, *Tradescantia guatemalensis* C. B. Clarke ex J. D. Smith, coholom, $2n = 42$, the spathes subtending the inflorescence are connate basally, forming a short tube that encloses the buds. The species is endemic to southern Mexico and northern Central America. The plants are self-incompatible.

Section CORINNA Hunt also includes a single species, *Tradescantia soconuscana* Matuda (*Campelia Standleyi* Steyerm.), $2n = 26$, of southern Mexico and Guatemala. Its karyotype consists of small chromosomes, of which six are metacentric, 16 acrocentric, and four telocentric.

Plants of sect. AUSTROTRADESCANTIA Hunt are procumbent and leafy stemmed; the spathes are conspicuously broader than the stem leaves. The chromosomes are very small for the genus, the diploid number ranging from 40 to 110. The four to six species are found in southeastern Brazil, Uruguay, Paraguay, and northern Argentina. *Tradescantia fluminensis* Vell., $2n = 40$, 67 (Owens), a native of southeastern Brazil, is adventive in southwestern Georgia, central and western Florida, southern Alabama, Louisiana, and California. In New Zealand, where it is also naturalized, it forms dense, matlike stands in lowland forests. These populations exclude most tree seedlings and inhibit the reproduction of the native woody plants. Apparently all reproduction of *T. fluminensis* in New Zealand is vegetative. A node with as little as 1 cm of stem attached is able to sprout and form a new plant. Thus, trampling stands of *T. fluminensis* fragments the plants and enhances their reproduction (Kelly & Skipworth).

Tradescantia virginiana, T. ohiensis, and *T. paludosa,* or hybrids between them, are regularly used to monitor radiation and other environmental contaminants. Clones heterozygous for flower color are exposed to the prospective hazard. Radiation or chemical mutagens cause somatic mutations, resulting in production of pink (recessive) rather than blue (dominant) flowers. When a cell of a stamen hair is affected, the change can be readily spotted under low-power magnification. When exposed to X rays, gamma rays, or neutron radiation, the number of pink cells per flower increases linearly with the intensity of radiation. Chemical mutagens have a similar effect. Ichikawa (1984) surveyed 16 clones of *Tradescantia* (pure species, hybrids, diploids, triploids, and tetraploids). The sensitivity to radiation damage was 50–60 times greater in the

most than in the least sensitive clone. The differences in sensitivity of the taxa showed no apparent taxonomic correlation but were believed to result from differences in the genetic repair system.

The *Tradescantia* micronucleus-test (Ma, 1981) makes use of the highly synchronous prophase and tetrad stages in microsporogenesis in clones of *T. paludosa*. Radiation or chemical mutagens can break chromatids, and acentric fragments are formed. At the tetrad stage these fragments form micronuclei that are easily spotted and tallied from aceto-carmine squashes. The frequency of micronuclei is indicative of the level of radiation or the mutagenicity of the chemical in question. This highly sensitive test is often used to monitor the purity of drinking-water supplies (Ma *et al.*).

REFERENCES:

Under family references see BRENAN (1966); BRÜCKNER (1926, 1927, 1930); CELARIER; CHANT; CLARKE; CLEWELL; FADEN (1985); FERNALD; FERNALD & KINSEY; GUERVIN & LE COQ; HANDLOS (1970); HERD & BEETLE; HOLM *et al.*; HUNT (1975a; 1980; 1981; 1984; 1986b, c); JONES & JOPLING; LONG & LAKELA; MATTHEWS; MATUDA (1955, 1956); MAYER & POLJAKOFF-MAYBER; OWENS; OWENS & KIMMINS; PICHON; POOLE & HUNT; ROWLEY; STURTEVANT; TIWARI & GUNNING; TOMLINSON (1966, 1969); WOODSON; WUNDERLIN; and YANOVSKY.

ALLEN, N. S., G. B. WILSON, & S. POWELL. Comparative effects of colchicine and sodium nucleate on somatic chromosomes of *Allium* and *Tradescantia*. Jour. Hered. **41:** 159–163. 1950.

ANDERSON, E. Binary variation in *Tradescantia bracteata*. Ann. Missouri Bot. Gard. **28:** 147–163. 1941. [A species of the upper Mississippi drainage.]

———. A field survey of chromosome numbers in the species of *Tradescantia* closely allied to *Tradescantia virginiana*. *Ibid.* **41:** 305–327. 1954.

——— & K. SAX. A cytological analysis of self-sterility in *Tradescantia*. Bot. Gaz. **95:** 609–662. 1934. [Illustrations.]

——— & R. E. WOODSON. The species of *Tradescantia* indigenous to the United States. Contr. Arnold Arb. **9:** 1–132. *pls. 1–12.* 1935.

BAUM, J. W., & C. H. NAUMAN. Influence of strong magnetic fields on genetic end points in *Tradescantia* tetrads and stamen hairs. Environm. Mutagen. **6:** 49–58. 1984.

BISHOP, C. J. Differential x-ray sensitivity of *Tradescantia* chromosomes during the mitotic cycle. Genetics **35:** 175–187. 1950.

———. Influence of polyploidy on the x-ray sensitivity of cells. Canad. Jour. Bot. **30:** 139–146. 1952.

——— & L. J. MCGOWAN. The role of the vegetative nucleus in pollen tube growth and the division of the generative nucleus in *Tradescantia paludosa*. Am. Jour. Bot. **40:** 658, 659. 1953.

BOLICK, M. R. *Tradescantia bracteata* Small and *T. occidentalis* (Britt.) Smyth in the Great Plains. (Abstract.) Bot. Soc. Am. Misc. Ser. Publ. **160:** 63. 1981.

BORA, K. C. Delayed effects of chromosome breakage by x-rays in *Tradescantia bracteata*. Jour. Genet. **52:** 140–151. 1954.

———. The influence of temperature on the production of chromosome aberrations by fractional x-ray doses in the microspores of *Tradescantia bracteata*. *Ibid.* **53:** 29–48. 1955.

BUSH, B. F. Two new Texas tradescantias. Ann. Rep. Missouri Bot. Gard. **16:** 100, 101. 1905.

CELARIER, R. P. Cytology of the Tradescantieae. Bull. Torrey Bot. Club **82:** 30–38. 1955.

———. Desynapsis in *Tradescantia*. Cytologia **20:** 69–83. 1955.
———. A new species of *Tradescantia* (Commelinaceae) from south Texas. Field Lab. **24:** 5–9. 1956.
CLARKE, E., & M. W. STEER. Cytoplasmic structure of germinated and ungerminated pollen grains of *Tradescantia virginiana*. Caryologia **36:** 299–306. 1983.
CONGER, A. Radiobiological studies with *Tradescantia* at nuclear test detonations. Am. Nat. **88:** 215–224. 1954.
COUOT-GASTELIER, J., D. LAFFRAY, & P. LOUGUET. Comparative ultrastructural study of opened and closed stomata in *Tradescantia virginiana*. Canad. Jour. Bot. **62:** 1505–1512. 1984.
DEAN, D. S. Distribution of tetraploid and diploid *Tradescantia ohiensis* in Michigan and adjoining areas. Am. Midl. Nat. **61:** 204–209. 1959.
DRYANOVSKA, O. A. Cytochemical and radiographic studies of meiosis and microsporogenesis in *Tradescantia paludosa*. Compt. Rend. Acad. Sci. Bulg. **34:** 1169–1172. 1981.*
——— & H. TITSU. Electron microscopic investigations of microsporogenesis and the pollen grain in *Tradescantia paludosa*. Compt. Rend. Acad. Sci. Bulg. **34:** 257–260. 1981.*
EMMERLING-THOMPSON, M., & M. M. NAWROCKY. Evidence of gametic mutation for flower color in *Tradescantia subacaulis*. Environ. Exp. Bot. **22:** 403–408. 1982.
FERNALD, M. L. Two of Rafinesque's species of *Tradescantia*. Rhodora **46:** 310, 311. 1944.
FOURCROY, M. Nouvel exemple de racine bistélique: *Tradescantia virginica*. Bull. Soc. Bot. France **103:** 590–595. 1956.
———. Remarque au sujet de la systématique de trois *Tradescantia*. *Ibid.* **104:** 605–608. 1957. ["*T. reflexa* et *T. virginica*, souvent confondus par les auteurs, présentent une structure radiculaire différente qui vient à l'appui de leur distinction."]
FREEMAN, O. M. A dwarf *Tradescantia* in southwestern Abbeville County, South Carolina. Castanea **22:** 120, 121. 1957. [*T. brevicaulis*.]
FUJISHIMA, H. Karyological studies in Commelinaceae. IV. Karyotypes of genus *Tradescantia* (tropical species) and some species in affinitive genera. (In Japanese; English summary.) Kromosomo **85/86:** 2713–2727. 1971.
GALE, R. M. O., & S. J. OWENS. The occurrence of an epicuticular layer on the abaxial surface of petals in *Tradescantia* spp. (Commelinaceae). Kew Bull. **37:** 515–520. 1983.
GILES, N. Chromosome behavior at meiosis in triploid *Tradescantia* hybrids. Bull. Torrey Bot. Club **68:** 207–221. 1941.
GUNCKEL, J. E., I. B. MORROW, A. H. SPARROW, & E. CHRISTENSEN. Variations in the floral morphology of normal and irradiated plants of *Tradescantia paludosa*. Bull. Torrey Bot. Club **80:** 445–456. 1953.
HAQUE, A. Effect of infra-red rays on chromosome breakage in *Tradescantia*. Cytologia **20:** 229–236. 1955.
HEJNOWICZ, Z. Interpretation und Tatsache in Bezug auf die Entwicklungsmechanik der Variegatio bei *Tradescantia fluminensis* var. *albostriata*. Acta Soc. Bot. Polon. **26:** 255, 256. 1957.
HASENKAMPF, C. A. Longitudinal axis thickenings in whole mount spreads of synaptonemal complexes from *Tradescantia ohiensis* var. *paludosa*. Chromosoma **90:** 285–288. 1984.
——— & M. Y. MENZEL. Whole-mount spread preparations of zygotene chromosomes of *Tradescantia*. (Abstract.) Am. Jour. Bot. **71**(5, part 2): 104. 1984.
HORIE, K. The behavior of the petals in the fading of the flowers of *Tradescantia reflexa*. Protoplasma **53:** 377–386. 1961.
HUNT, D. R. *Tradescantia Mirandae*, Commelinaceae. Curtis's Bot. Mag. **178:** *t. 615*. 3 unnumbered pp. 1972.

ICHIKAWA, S. In-situ monitoring with *Tradescantia* around nuclear power plants. Environ. Health Perspect. **37:** 145–164. 1981.

———. Spontaneous somatic mutation frequencies in the stamen hairs of 14 different *Tradescantia* clones heterozygous for flower color. Environ. Exper. Bot. **24:** 259–266. 1984.

———, C. S. TAKAHASHI, & C. ISHII-NAGASHIMA. Somatic mutation frequency in the stamen hairs of *Tradescantia* KU-7 and KU-9 clones exposed to low level gamma-rays. Jap. Jour. Genet. **56:** 409–424. 1981.

JONES, K., A. KENTON, & D. R. HUNT. Contributions to the cytotaxonomy of the Commelinaceae. Chromosome evolution in *Tradescantia* section *Cymbispatha*. Jour. Linn. Soc. Bot. **83:** 157–188. 1981.

KAMIZYO, A., & N. TANAKA. Studies on the generative nuclear division, 4. Effect of sucrose in artificial medium on the generative division in *Tradescantia paludosa*. Cytologia **47:** 207–218. 1982.

KEHLHOFFNER, J. L., & J. DIETRICH. Synaptonemal complex and a new type of nuclear poly-complex in 3 higher plants: *Paeonia tenuifolia, Paeonia Delavayi,* and *Tradescantia paludosa*. Chromosoma **88:** 164–170. 1983.

KELLY, D., & J. P. SKIPWORTH. *Tradescantia fluminensis* in a manawatu New Zealand forest. New Zealand Jour. Bot. **22:** 393–398. 1984.

KELSO, J. M., & J. S. TURNER. Protoplasmic streaming in *Tradescantia*. I. The effects of indoleacetic acid and other growth-promoting substances on streaming. Austral. Jour. Biol. Sci. **8:** 19–35. 1955.

LAFLEUR, G. J., A. E. GROSS, & J. P. MASCARENHAS. Optimization of culture conditions for the formation of sperm cells in pollen tubes of *Tradescantia paludosa*. Gamete Res. **4:** 35–40. 1981.

LELONG, M. G. Noteworthy monocots of Mobile and Baldwin counties, Alabama. Sida **13:** 101–113. 1988. [*T. fluminensis*.]

LEVIN, G. G. Age-related changes in the resistance to light and moisture deficiencies in *Tradescantia fluminensis* (Commelinaceae) leaves and stems. (In Russian.) Bot. Zhur. Leningrad **71:** 334–341. 1986.

LIMA DE FARIA, A. Structure, division, and delimitation of the kinetochore in *Tradescantia*. Hereditas **41:** 209–226. 1955.

LIN, Y. J., & E. F. PADDOCK. Ring-position and frequency of adjacent distribution of meiotic chromosomes in *Rhoeo spathacea*. Am. Jour. Bot. **60:** 685–690. 1973.

MA, T. H. Thin-layer lactose agar for pollen tube culture of *Tradescantia* to enhance planar distribution of chromosomes. Stain Tech. **42:** 285–291. 1967. [*T. paludosa*.]

———. *Tradescantia paludosa* micro-nucleus bioassay and pollen tube chromatid aberration test for in-situ monitoring and mutagen screening. Environ. Health Perspect. **37:** 85–90. 1981.

———, V. A. ANDERSON, M. M. HARRIS, R. E. NEAS, & T. S. LEE. Mutagenicity of drinking water detected by the *Tradescantia* micronucleus test. Canad. Jour. Genet. Cytol. **27:** 143–150. 1985.

MACROBERTS, D. T. Notes on *Tradescantia* (Commelinaceae). V. *Tradescantia* of Louisiana. Bull. Mus. Life Sci. Louisiana State Univ. Shreveport **4.** 15 pp. 1980. [Seven species; keys, descriptions; distribution maps for Louisiana only.]

MARIMUTHU, K. M., L. A. SCHAIRER, A. H. SPARROW, & M. M. NAWROCKY. Effects of space flight (Biosatellite II) and radiation on female gametophyte development in *Tradescantia*. Am. Jour. Bot. **59:** 359–366. 1972.

MARTIN, E. S., & H. MEIDNER. Endogenous stomatal movements in *Tradescantia virginiana*. New Phytol. **70:** 923–928. 1971.

MATTHEWS, B. Called flower of a day, *Tradescantia* blooms through three seasons. New Zealand Gard. **2:** 258, 259. 1946.*

MITSUKURI, Y., & K. SHIRATO. Cytological studies on Commelinaceae. III. The study

of *Tradescantia* having the chromosome number $2n = 18$. (In Japanese; English abstract.) Jap. Jour. Genet. **32:** 251. 1957.

———, T. TOYODA, & K. NOMURA. Karyotype analysis in *Tradescantia*. (In Japanese; English abstract.). Jap. Jour. Genet. **31:** 304. 1956.

MOORE, H. E. *Campelia Zanonia* in cultivation. Baileya **7:** 42–44. 1959.

———. *Tradescantia pexata* (Commelinaceae), a new species. *Ibid.* **8:** 99–101. 1960.

NAKAMURA, Y., & Y. OHMOMO. Transfer of gaseous iodine to *Tradescantia*. Jour. Radiation Res. **25:** 251–259. 1984.

OWENS, S. J., & S. MCGRATH. Self-incompatibility and the pollen-stigma interaction in *Tradescantia ohiensis*. Protoplasma **121:** 209–213. 1984.

PANDITA, T. K., & P. N. MEHRA. Cytology of tetraploid *Tradescantia canaliculata*. Nucleus (Calcutta) **26:** 90–93. 1983.*

PARCHMAN, L. G. The morphogenesis of the stamen hairs of *Tradescantia paludosa*. Diss. Abstr. **25**(12, part 1): 6915. 1965.

PUZA, V. Die Amitose bei *Tradescantia virginica* L. Protoplasma **59:** 589–593. 1965.

RECHEL, E. A., & W. F. CAMPBELL. The effects of radiation from uranium mill tailings on *Tradescantia*. Great Basin Nat. **38:** 456–462. 1978.

RILEY, H. P. Introgressive hybridization in a natural population of *Tradescantia*. Genetics **24:** 753–769. 1939.

RIVIÈRE, S. Une fausse bistélie de la racine de *Tradescantia virginica*. Bull. Soc. Bot. France **103:** 596–598. 1956.

ROSE, J. N. Three new species of *Tradescantia* from the United States. Contr. U. S. Natl. Herb. **5:** 204–206. 1899.

SAKAI WADA, A. Ultrastructural and cytochemical studies on the synaptonemal complex of *Tradescantia reflexa*. Cytologia **48:** 859–868. 1983.

SASSEN, M. M. A., & A. M. C. WOLTERS-ARTS. Cell wall texture and cortical microtubules in growing staminal hairs of *Tradescantia virginiana*. Acta Bot. Neerl. **35:** 351–360. 1986.

SAX, K., & H. W. EDMONDS. Development of the male gametophyte in *Tradescantia*. Bot. Gaz. **95:** 156–163. 1933.

SCHMITT, F. O., & G. T. JOHNSON. Optical and chemical studies on the granules in microspores of *Tradescantia*. Ann. Missouri Bot. Gard. **25:** 455–466. 1938.

SCOTT, L. I. & J. H. PRIESTLEY. Leaf and stem anatomy of *Tradescantia fluminensis* Vel. Jour. Linn. Soc. Bot. **47:** 1–28. 1925.

SKIRM, G. W. Bivalent pairing in an induced tetraploid of *Tradescantia*. Genetics **27:** 635–640. 1942.

SLAVIN, A. D., & J. A. NIEUWLAND. A new form of *Tradescantia reflexa*. Am. Midl. Nat. **11:** 600. 1929.

SMALL, J. K. *Tradescantia longifolia*. Addisonia **17:** 17, 18. *pl. 553.* 1932.

STEARN, W. T. The boat-lily (*Rhoeo spathacea*). Baileya **5:** 195–198. 1957.

STEFFENSEN, D. Irregularities of chromosome division in *Tradescantia* grown on low sulfate. Exper. Cell Res. **6:** 554–556. 1954. [*T. paludosa.*]

STINSON, J. R., & J. P. MASCARENHAS. Fate of messenger RNA in the mature pollen grain of *Tradescantia paludosa* during germination and pollen tube growth. Pp. 510, 511 *in* D. L. MULCAHY *et al.*, eds., Biotechnology and ecology of pollen. Secaucus, New Jersey, and Berlin. 1986.

SWANSON, C. P. The distribution of inversions in *Tradescantia*. Genetics **25:** 438–465. 1940.

———. Secondary association of fragment chromosomes in generative nucleus of *Tradescantia* and its bearing on their origin. Bot. Gaz. **105:** 108–112. 1943.

TABER, R. A., & M. E. STRONG. Vesicular-arbuscular mycorrhizae in roots and xylem of *Tradescantia virginiana*. Mycologia **74:** 152–156. 1982.

——— & W. A. TABER. Evidence for ectomycorrhizal fungus-mediated nutrient transfer between *Pinus* and *Tradescantia*. Forest Sci. **30:** 892–896. 1984.*

THIERET, J. W. Additions to the flora of Louisiana. Castanea **28:** 169, 170. 1963. [*T. subaspera,* 170.]

TIMME, S. L., & R. B. FADEN. *Tradescantia longipes* (Commelinaceae) in the southeastern U. S. A. Castanea **49:** 83–85. 1984. [Missouri and Arkansas.]

TOMOS, A. D., E. STEUDLE, U. ZIMMERMANN, & E.-D. SCHULZE. Water relations of leaf epidermal cells of *Tradescantia virginiana.* Pl. Physiol. **68:** 1135–1143. 1981.

UNDERBRINK, A. G., R. C. SPARROW, & A. H. SPARROW. Relations between phenotypic aberrations and loss of reproductive integrity in *Tradescantia* stamen hairs. Radiat. Bot. **11:** 473–481. 1971.

WATERFALL, U. T. *Separotheca,* a new genus (Commelinaceae) from Mexico. Rhodora **61:** 136–139. 1959.

WHALLON, J. Scanning electron microscopy of meiotic chromosomes of *Tradescantia gigantea.* Cytobios **38:** 137–148. 1983.*

WUNDERLIN, R. P., B. F. HANSEN, & D. W. HALL. The vascular flora of central Florida: taxonomic and nomenclatural changes, additional taxa. II. Sida **13:** 83–91. 1988.

2. **Callisia** Loefling, Iter Hisp. 305. 1758.

Perennial [annual] herbs. Rhizomes present or lacking. Stems erect or decumbent and rooting at the nodes. Leaves several to many, cauline, spiraled or distichous; sheaths shorter than blades, the apex ciliate; blades oblong-lanceolate to linear. Inflorescences axillary or terminal, cymose; spathe solitary, with or without leaflike blade; bracteoles smaller than leaves, generally scarious. Pedicels elongate or very short, glandular-pubescent and/or villous. Sepals 3, equal, broadly elliptic to lanceolate, the apex rounded or acute, free or connate for the basal ⅓, the outer surface with many short glandular hairs. Petals (2 or) 3, orbiculate to narrowly oblong, free, subequal, glabrous. Stamens [1, 3, or] 6, all fertile; filaments slender, glabrous or hairy; anthers broadly ovate, the connective rectangular, about as wide as the anther locule. Ovaries oblong-ellipsoid, 3-locular, each locule with 2 ovules; style shorter than to 2–3 times longer than ovary; stigma club shaped, rough (sometimes shortly plumose). Fruit a capsule, [2- or] 3-locular, each locule containing [1 or] 2 seed(s). Seeds ovoid, dorsiventrally flattened, the surface rugose. Base chromosome numbers 6, 7, 8. (Including *Aploleia* Raf., *Cuthbertia* Small, *Leptorhoeo* Hemsley, *Phyodina* Raf., *Tradescantella* Small.) TYPES SPECIES: *C. repens* L. (Name from Greek *kallos,* pretty.)—BASKET-PLANT.

A genus of about 20 species of the tropical and subtropical regions of the New World. The circumscription of the genus adopted here follows that of Hunt. Four of the six sections are represented in the United States, with three of these in our area. Like its close relatives *Tradescantia* and *Tripogandra, Callisia* has fused pairs of cymes. It differs from *Tradescantia* in having single (vs. paired) inflorescence spathes and glabrous (vs. hairy) filaments; from *Tripogandra,* in lacking dimorphic pollen (Mattson) and in having actinomorphic (vs. zygomorphic) flowers. Ecologically, species of *Callisia* generally grow in drier situations than those of either *Tradescantia* or *Tripogandra.*

Section CUTHBERTIA (Small) Hunt (*Cuthbertia* Small) consists of three species, all endemic to the Coastal Plain and Piedmont from Virginia to Florida. They are erect plants with linear leaves and both lateral and terminal inflorescences

subtended by inconspicuous spathes. The base chromosome number is 6, and the karyotype comprises 2 metacentric and 4 subtelocentric chromosomes. Although these species have been included in *Tradescantia* by some workers, they differ from that genus in morphology, anatomy (Tomlinson, 1969), cytology (Giles, 1942, 1943), and chemistry (Matthews). The removal of *Cuthbertia* from *Tradescantia* has gained general acceptance. Rohweder included the species in *Phyodina,* which in his classification comprised sects. CUTHBERTIA and LEPTOCALLISIA. The three species have all been treated as varieties of *Cuthbertia rosea* (= *Callisia rosea*) by some workers (e.g., Fernald).[5]

Callisia rosea (Vent.) Hunt (*Tradescantia rosea* Vent.; *Cuthbertia rosea* (Vent.) Small) (stems approximate, leaf blades as broad as or broader than sheaths), the most wide ranging of the three species, occurs from central North Carolina to southeastern Georgia and northeastern Florida.

Callisia graminea (Small) G. Tucker (stems densely caespitose, roots glabrous, inflorescence equaling or surpassed by leaf blades, spathes somewhat foliaceous) occurs on the Coastal Plain from southeastern Virginia to southern Florida. (It has also been reported from southeastern Oklahoma (Cleveland and Oklahoma counties) by Stemen & Myers, but I have seen no specimens to confirm this.) There are diploid, tetraploid, and hexaploid populations (Giles, 1942, 1943). The diploids are endemic to the sandhills region along the western edge of the Coastal Plain in southern North Carolina, while the tetraploids occupy habitats on the Coastal Plain from southeastern Virginia to southern Florida. Hexaploids are rare and have only been found from sites in South Carolina and Florida. The tetraploids averaged 25 percent larger in vegetative and floral parts than diploids. Lakela described a white-flowered form from central Florida, *C. graminea* f. *leucantha* (Lakela) G. Tucker. It produces vegetative plantlets from the axils of the upper leaves, but there are no other reports of vivipary in the genus.

Callisia ornata (Small) G. Tucker (stems approximate, roots woolly, inflorescence surpassing leaf blades, spathes scarious) is endemic to palm or pine scrub in central Florida.

Section LEPTOCALLISIA Bentham & Hooker (*Aploleia* Raf., *Leiandra* Raf., *Phyodina* Raf. in part, *Leptorhoeo* Hemsley, *Tradescantella* Small) includes six species of Florida, Texas, Mexico, and Central America. The base chromosome number is 7, and the stigmas are subcapitellate to penicilliform. One species, *Callisia cordifolia* (Sw.) Anderson & Woodson (*Tradescantia floridana* S. Watson, *Tradescantella floridana* (S. Watson) Small), grows in central and southern Florida. It is a procumbent plant that forms small mats on shaded rock or moss. The inflorescence is terminal, and the flowers pedicellate. The Neotropical *C. multiflora* (Martens & Gal.) Standley (*Aploleia multiflora* (Martens &

[5]Three new combinations are needed for the inclusion of *Cuthbertia* in *Callisia*:

Callisia graminea (Small) G. Tucker, based on *Cuthbertia graminea* Small, Fl. Southeast. U. S. 237, 1328. 1903.

Callisia graminea f. **leucantha** (Lakela) G. Tucker, based on *Cuthbertia graminea* f. *leucantha* Lakela, Sida **5**: 28. 1972.

Callisia ornata (Small) G. Tucker, based on *Cuthbertia ornata* Small, Man. Southeast. Fl. 259. 1933.

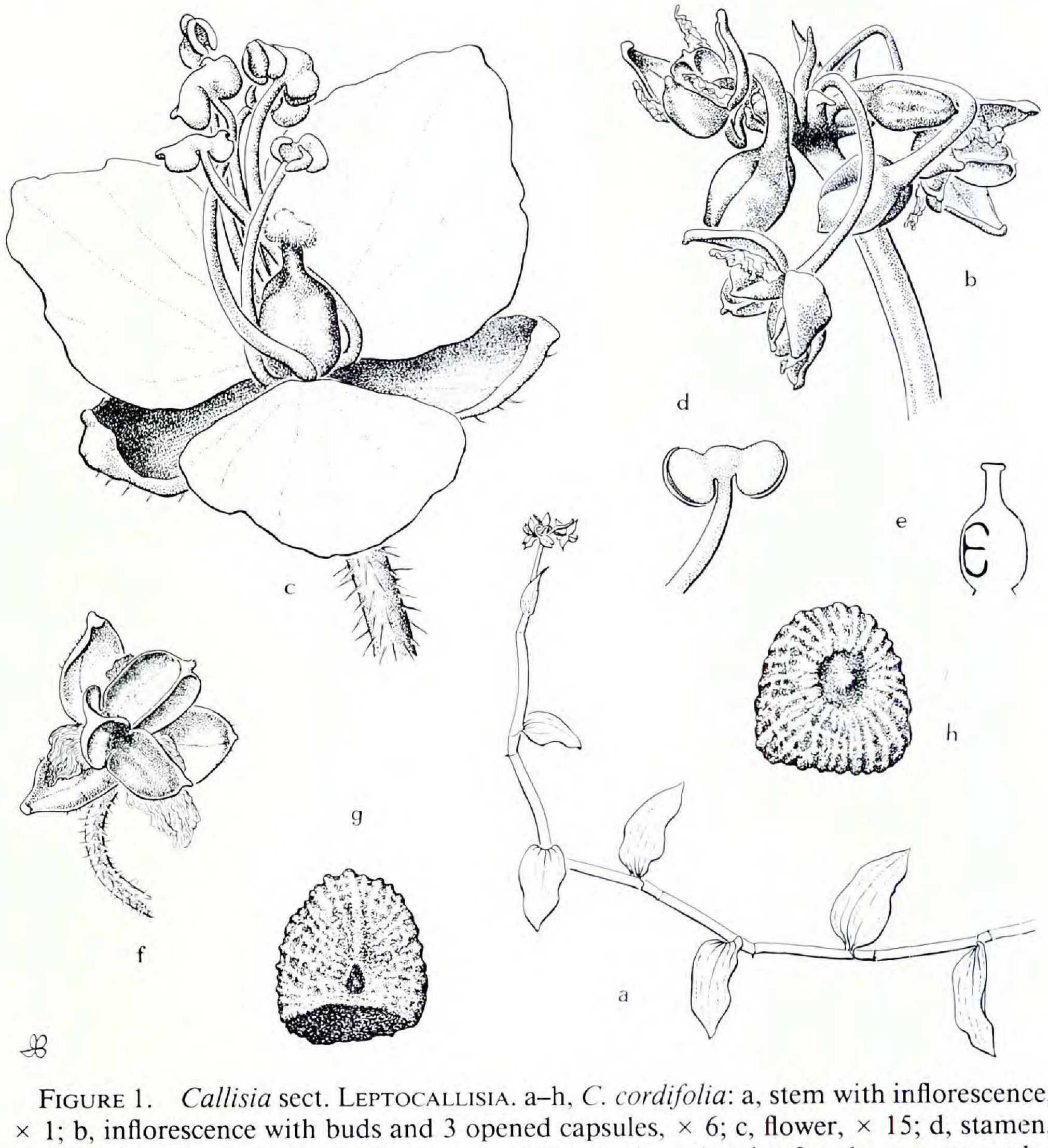

FIGURE 1. *Callisia* sect. LEPTOCALLISIA. a–h, *C. cordifolia*: a, stem with inflorescence, × 1; b, inflorescence with buds and 3 opened capsules, × 6; c, flower, × 15; d, stamen, × 25; e, diagrammatic longitudinal section of gynoecium showing 2 orthotropous ovules in 1 locule, × 12; f, open loculicidal capsule with marcescent petals and persistent sepals, × 8; g, seed, hilum below center, × 25; h, seed from opposite side, operculum at center, × 50.

Gal.) H. E. Moore), $2n = 28$, is self-incompatible, while *Callisia cordifolia* is unknown in this regard. The flowers of *C. multiflora* are unscented.

Section BRACHYPHYLLA Hunt (*Phyodina* Raf., in part) includes two species of Texas and northern Mexico. The plants are procumbent perennials with short, succulent leaves, subsessile terminal inflorescences, six stamens per flower, barbed filaments, and capitate stigmas. *Callisia navicularis* (Ortg.) Hunt (*P. navicularis* (Ortg.) Rohw.), $2n = 32$, and *C. micrantha* (Torrey) Hunt (*Tradescantia micrantha* Torrey, *P. micrantha* (Torrey) Hunt), $2n = 24$, are both self-incompatible (Owens).

Section HADRODEMAS (Moore) Hunt contains only *Callisia Warszawicziana* (Kunth & Bouché) Hunt, $2n = 16$, of Guatemala, a self-incompatible species.

The plants are thick-stemmed perennials with broadly lanceolate leaves, and their purple sepals are persistent (see Moore, 1962, for illustration).

Section LAUIA Hunt contains just *Callisia Laui* (Hunt) Hunt (*Phyodina Laui* Hunt), $2n = 12$, which is known only from southeastern Oaxaca, Mexico. The plants are tuberous, the inflorescences terminal and pedunculate, and the flowers pedicellate. The species is self-incompatible.

Section CALLISIA (*Hapalanthus* Jacq., nom. superfl., *Spironema* Lindley non Raf., *Rectanthera* Degener) comprises some ten Neotropical species with the base chromosome number six. The small, often bladeless petals and the bushy, exserted stigmas may be an adaptation to wind pollination, but this has not been demonstrated. One species, *Callisia repens* L. (including *C. insignis* C. B. Clarke), basket-plant, $2n = 24$, occurs in the Florida panhandle (Franklin County) and in peninsular Florida from Pinellas and Broward counties, and southward through the West Indies and Mexico to Brazil and Peru. It is similar in habit to *C. cordifolia* but has both axillary and terminal inflorescences of subsessile flowers partly enclosed in a bladeless sheath. The flowers of *C. repens* are unscented. *Callisia repens* is self-compatible, while the three other species of this section for which information is available—*C. Gentlei* Matuda (*C. elegans* E. J. Alexander ex H. E. Moore; *C. Macdougallii* Miranda) of northern Central America, *C. fragrans* (Lindley) Woodson of southeastern Mexico, and *C. soconuscensis* Matuda of Guerrero, Mexico, all $2n = 12$ (Owens)—are all self-incompatible.

Several species of *Callisia* are cultivated as creeping ground covers in frost-free areas. *Callisia fragrans* and similar procumbent species are sometimes grown indoors as hanging-basket plants.

REFERENCES:

Under family references see FADEN (1985); FERNALD; HUNT (1984, 1986d); MATTHEWS; MATTSON; OWENS; ROHWEDER; and TOMLINSON (1969).

ANDERSON, L. C. Noteworthy plants from North Florida. III. Sida **13:** 93–100. 1988. [*Callisia repens* in Franklin County.]

GILES, N. H., JR. Autopolyploidy and geographical distribution in *Cuthbertia graminea* Small. Am. Jour. Bot. **29:** 637–645. 1942.

———. Studies of natural populations of *Cuthbertia graminea* in the Carolinas. Jour. Elisha Mitchell Sci. Soc. **59:** 73–80. 1943.

LAKELA, O. Field observations of *Cuthbertia* (Commelinaceae) with description of a new form. Sida **5:** 26–32. 1972. [Illustrations; key to species of sect. CUTHBERTIA.]

MOORE, H. E. The genus *Aploleia* (Commelinaceae). Baileya **9:** 13–19. 1961. [Illustrations of *C. monandra, C. multiflora.*]

———. *Hadrodemas,* a new genus of Commelinaceae. *Ibid.* **10:** 130–136. 1962. [Illustrations.]

STEMEN, T. R., & W. S. MYERS. Oklahoma flora. xxxi + 706 pp. Oklahoma City. 1937.

3. **Gibasis** Rafinesque, Fl. Telluriensis **2:** 16. 1837.

Sprawling, weak-stemmed [erect] perennials [annuals]. Roots fibrous [tuberiferous]. Stems much branched, rooting at the nodes. Leaves several; sheaths ciliate apically; blades oblong-lanceolate to broadly or narrowly ovate. Inflo-

rescences several, terminal or axillary and terminal, cymose, 2[–8] per stipe; cincinnal axis short, thick; cincinnal bracts distichous, broadly rounded, suborbiculate; pedicels short. Flowers perfect, actinomorphic. Sepals 3, oblong-ovate, more or less keeled. Petals 3, oblong [orbiculate]. Stamens 3; filaments bearded, the hairs moniliform; anthers orbiculate, dehiscing laterally; connective rectangular, broader than long. Ovary 3-locular, ovules 2 per locule; style glabrous; stigma subtly 3-lobed, capitellate. Fruit a capsule. Seeds ovoid [oblong-ovoid], the hilum elongate-punctiform [linear]. Base chromosome number 6. TYPE SPECIES: *Tradescantia pulchella* HBK. (= *G. pulchella* (HBK.) Raf.), the only species included by Rafinesque. (Name from Latin *gibba,* gibbous, and *basis,* base, referring to the "gibbous base," presumably of the asymmetric leaves.)—BRIDAL-VEIL.

A genus of 11 species of Mexico and, to a lesser extent, the Caribbean region and tropical South America. *Gibasis* is characterized by features of the inflorescence, which is made up of paired cymes borne on stipes. The paired cymes are not fused, as in the closely related *Tradescantia.* The cyme axis in *Gibasis* bears two rows of broad scalelike bracteoles, each subtending a single flower.

In his revision of the genus, Hunt (1986a) recognized two sections. Section GIBASIS has tuberiferous roots, oblong-lanceolate to broadly ovate leaves, and pink flowers. The plants are self-incompatible. The chromosomes are large, and the base numbers are 4, 5, or 6. Sulfated phenolic acids are absent (Del Pero de Martínez). There are eight species, mostly restricted to the uplands of Mexico: *G. chihuahuensis* (Standley) Rohw.; *G. consobrina* Hunt, $2n = 20$; *G. Karwinskyana* (Schultes f.) Rohw., $2n = 10, 20, 30$; *G. linearis* (Bentham) Rohw., $2n = 10, 12, 20, 22$; *G. Matudae* Hunt, $2n = 10$; *G. pulchella,* $2n = 10, 15$; *G. triflora* (Martens & Gal.) Hunt, $2n = 10$; and *G. venustula* (Kunth) Hunt, $2n = 12$. Cyme axes in *G. pulchella* are reflexed 180° and fused to the upper stipe, so the first flowers to open seem to be those most distal in the inflorescence.

Plants of sect. HETEROBASIS Hunt have nontuberiferous roots, linear to ovate-lanceolate leaves, and white, self-compatible flowers. The chromosomes are small, and the base number is 8 (Owens, 1977). Sulfated phenolic acids are present. There are three species. *Gibasis oaxacana* Hunt, $2n = 12$, is endemic to Oaxaca, Mexico. *Gibasis pellucida,* $2n = 10, 16$, with leaves and stems glabrescent, and filaments hairy throughout, is widespread in the lowlands of southern Mexico (dubiously reported from Cuba and the Dominican Republic); it has been collected as a weed in southern Florida (Dade County, *Hansen & Sauleda 10732,* USF, and Sarasota County, *Waldo s.n.,* 4 May 1971, NYS). *Gibasis geniculata,* $2n = 48, 52$, with leaves and stems villous and filaments hairy basally, is the only wide-ranging species, occurring from Haiti and southern Mexico south to northern Argentina. It has been reported from central Florida as an escape (Wunderlin), but I have seen no specimens. Hunt (1986a) did not mention the genus as being represented in the United States.

Leaf anatomy of *Gibasis geniculata, G. Matudae,* and *G. Schiedeana* (Kunth) Hunt (= *G. pellucida*) has been investigated by Stant. She found three kinds of hairs: short, 2-celled, hook or prickle hairs; glandular, 3-celled ones; and

long, 4- to 6-celled trichomes. All three types were present in various amounts in the three species, but differences were apparently not taxonomically useful.

Gibasis pellucida, Tahitian bridal veil, is widely cultivated in the United States and Mexico. It has often been confused with *G. geniculata* (Hunt, 1986a).

REFERENCES:

Under family references see BRENAN (1966); BRÜCKNER (1926, 1927, 1930); CLARKE; DEL PERO DE MARTÍNEZ; FADEN (1985); HUNT (1975b, 1978, 1984, 1986a); JONES & JOPLING; OWENS (1981); OWENS & KIMMINS; POOLE & HUNT; ROHWEDER; TOMLINSON (1966, 1969); WOODSON; and WUNDERLIN.

BRANDHAM, P. E., & S. BHATTARAI. The effect of B chromosome number on chiasma frequency within and between individuals of *Gibasis linearis* (Commelinaceae). Chromosoma **64:** 343–348. 1977.

HUNT, D. R. *Gibasis oaxacana.* Curtis's Bot. Mag. **179:** *t. 624.* 1972.

———. *Gibasis Schiedeana. Ibid. t. 636.* 1973. [= *G. pellucida.*]

JONES, K. Chromosome evolution by Robertsonian translocation in *Gibasis* (Commelinaceae). Chromosoma **45:** 353–368. 1974.

———, S. BHATTARAI, & D. R. HUNT. Contributions to the cytotaxonomy of the Commelinaceae. *Gibasis linearis* and its allies. Jour. Linn. Soc. Bot. **83:** 129–162. 1981.

———, D. PAPEŠ, & D. R. HUNT. Contributions to the cytotaxonomy of the Commelinaceae. II. Further observations on *Gibasis geniculata* and its allies. Jour. Linn. Soc. Bot. **71:** 145–166. 1975.

KENTON, A. Giemsa C-banding in *Gibasis* (Commelinaceae). Chromosoma **65:** 309–324. 1978.

———. Chromosome evolution in the *Gibasis linearis* alliance (Commelinaceae) I. The Robertsonian differentiation of *G. venustula* and *G. speciosa. Ibid.* **84:** 291–304. 1981.

———. Chromosome evolution in the *Gibasis linearis* group (Commelinaceae) II. Robertsonian differentiation and preferential pairing revealed in species and F_1 hybrids of the *Gibasis linearis* group (Commelinaceae). Pl. Syst. Evol. **144:** 221–240. 1984a.

———. Chromosome evolution in the *Gibasis linearis* group (Commelinaceae) III. DNA variation, chromosome evolution, and speciation in *G. venustula* and *G. heterophylla* ($2n = 12$). Chromosoma **99:** 1–8. 1984b.

OWENS, S. J. Incompatibility studies in the genus *Gibasis* section *Heterobasis* D. R. Hunt (Commelinaceae). Heredity **39:** 365–371. 1977.

REYNOLDS, T. An analysis of enzyme multiple form variation in relation to cytology and morphology in *Gibasis Schiedeana* I. Peroxidases. Kew Bull. **34:** 83–111. 1979.

——— & I. L. GILBERT. An analysis of enzyme multiple form variation in relation to cytology and morphology in *Gibasis Schiedeana* (Commelinaceae) II. Acid phosphatases. *Ibid.* **36:** 575–589. 1981.

STANT, M. Y. Scanning electron microscopy of silica bodies and other epidermal features in *Gibasis* (*Tradescantia*) leaf. Jour. Linn. Soc. Bot. **66:** 233–243. *pls. 1–5.* 1973.

Tribe COMMELINEAE

4. **Murdannia** Royle, Illus. Bot. Himalayan Mtns. 403. 1840, nom. cons.

Perennial or annual herbs. Roots fibrous [sometimes uniformly thickened throughout]. Stems smooth. Leaves several, cauline [basal only, or both basal and cauline]; sheaths closed; petioles lacking; blades [broadly] narrowly lanceolate, the base rounded [cordate], the margins and apex with papillae or

prickles. Inflorescences axillary and terminal [terminal only], thyrsiform, open. Pedicels erect to ascending. Flowers 1 to many, perfect, actinomorphic. Sepals 3, equal. Petals 3, equal, oblong, not clawed. Stamens 2 or 3, antesepalous; filaments glabrous or bearded; staminodia [lacking, 1, 2, or] 3, antepetalous; sterile anthers 3-lobed. Ovary trilocular, glabrous or glandular-pubescent; ovules uni- or biseriate, 2 (or 3) per locule; stigma capitate. Fruit a capsule. Seeds broadly oblong, hilum punctate to linear. Base chromosome number 10. TYPE SPECIES: *Commelina scapiflora* Roxb. (*M. scapiflora* (Roxb.) Royle = *M. edulis* (Stokes) Faden). (Named for Murdan Aly, plant collector and keeper of the herbarium at Saharanpur, India, in the mid-nineteenth century.)

A genus of 40–45 species of tropical and warm-temperate regions of the Old and New worlds. The genus is most diverse in southern Asia, where some 30 species occur (Faden, 1975). There are seven species in the New World, four of them South American endemics.

Murdannia has long been confused with *Aneilema* R. Br., but Faden (1975) pointed out that the confusion seems to have been from the publication of numerous species of *Murdannia* under *Aneilema* rather than from close relationship. The two genera are distinguished on the basis of androecial structure, but since floral features are poorly preserved in pressed specimens, this character has often been overlooked. In *Murdannia* the stamens alternate with the staminodia, while in *Aneilema* they are clustered below the staminodia (see Faden, 1975, for illustration). The closest relative of *Murdannia* is the monotypic African genus *Anthericopsis* Engler.

The alternating arrangement of stamens and staminodia that characterizes *Murdannia* is also found in *Palisota* Reichenb. (in this genus the stamens are antepetalous and the staminodia antesepalous, the reverse of the situation in *Murdannia*), *Pseudoparis* (antepetalous staminodia, but petiolate leaves), and *Anthericopsis* (3-locular dehiscent capsules as in *Murdannia,* but sessile subopposite inflorescences, larger chromosomes, and base chromosome number 7).

Murdannia nudiflora (L.) Brückner is widespread in Latin America and extends northward to Florida and southeastern Georgia; it is also known from Louisiana (reported from coastal North and South Carolina by Radford and colleagues; no specimens seen). The plants are caespitose and do not root at the nodes. The longest pedicels about equal the capsule, which is usually 1.25 times longer than wide. When the fruit is mature, the sepals are hyaline. The seeds are 1.2–1.5 mm long. *Murdannia spirata* (L.) Brenan, an Asian species, is adventive in southern Florida (specimens seen from Charlotte, Glades, Lee, Hendry, and Collier counties). Although this species and *M. nudiflora* are similar, *M. spirata* has persistent bracteoles on the inflorescence branches and the longest pedicels two to three times longer than the capsules. It was first reported in the New World from Collier County, Florida, in 1968 (Lakela).

Murdannia Keisak (Hassk.) Hand.-Mazz. (*Aneilema Keisak* Hassk.), $2n = 32, 40$, is naturalized in the area from eastern Maryland to Florida westward to Louisiana, and it has recently been reported from central and eastern Tennessee and southeastern Kentucky. The plants are single stemmed and often

root at the lower nodes, the pedicels are several times longer than the capsules, the sepals are green and develop sessile reddish glands in fruit, and the seeds are about 3 mm long. The karyotype of *Murdannia Keisak* comprises five metacentric, 12 submetacentric, and three subtelocentric pairs of chromosomes (Fujishima). Fernald thought this species to be native to eastern North America, but Shinners pointed out that its rapid spread since the 1930's indicated the weedy behavior of an adventive.

In western Australia *Murdannia nudiflora* produces cleistogamous flowers during rainy weather and chasmogamous ones when it is sunny (Keighery). Chasmogamous flowers are self pollinated, with the anthers dehiscing directly onto the receptive stigmas. No pollinators were observed visiting the open flowers. *Murdannia nudiflora* is self-compatible (Owens), as is *M. simplex* (Vahl) Brenan.

Murdannia Keisak is a significant weed in Japan. Although it has spread rapidly in the Southeast in the last 50 years, it does not appear to have become a weed here.

REFERENCES:

Under family references see BAILEY *et al.*; FADEN (1975, 1985); FERNALD; OWENS; and RADFORD *et al.*

ALLEN, C. M. *Murdannia Keisak* (Hassk.) Hand.-Mazz. (Commelinaceae), *Bothriochloa hybrida* (Gould) Gould (Poaceae), and *Scutellaria racemosa* Pers. (Lamiaceae) new to Louisiana. Sida **10:** 189, 190. 1983.

DARWIN, S. P., E. G. SUNDELL, & A. S. BRADBURN. Noteworthy vascular plants from Louisiana, U. S. A. Sida **9:** 70–75. 1981.

FUJISHIMA, H. Karyological studies in Commelinaceae, II. Karyotypes of *Pollia japonica* and *Aneilema Keisak*. Bot. Mag. Tokyo **83:** 21–26. 1970.

KEIGHERY, G. J. Facultative cleistogamy in *Murdannia nudiflora* (Commelinaceae). Flora **172:** 327, 328. 1982. [Illustrations.]

LAKELA, O. Occurrence of *Murdannia spirata* in Florida. Rhodora **70:** 571–573. 1968. [Illustration.]

SHINNERS, L. H. *Aneilema* (Commelinaceae) in the United States. Sida **1:** 100, 101. 1962. [*M. Keisak* (as *Aneilema Keisak*), *M. nudiflora* (as *A. nudiflorum*).]

SIPPLE, W. S., & R. H. WHEELER. On the presence of three vascular plants, *Melothria pendula, Carex extensa,* and *Aneilema Keisack* [*sic*], in Maryland. Chesapeake Sci. **15:** 173, 174. 1974. [*M. Keisak* in Charles and Wicomico counties.]

WHITE, P. S. New and noteworthy plants from the Great Smoky Mountains National Park, North Carolina and Tennessee. Castanea **47:** 78–83. 1982. [*M. Keisak,* 79, from Blount County, Tennessee.]

WOFFORD, B. E., D. H. WEBB, & W. M. DENNIS. State records and other recent noteworthy collections of Tennessee plants II. Castanea **42:** 190–193. 1977. [*M. Keisak* from Roane County, Tennessee.]

5. **Commelina** Linnaeus, Sp. Pl. **1:** 40. 1753; Gen. Pl. ed. 5. 25. 1754.

Annual or perennial herbs. Rhizomes lacking; roots fibrous. Stems simple or slightly branched [acaulescent], glabrous. Leaves several, cauline; sheaths closed; blades broadly to narrowly lanceolate, flat or nearly so. Inflorescences axillary [scapose], each subtended by an orbiculate to oblong, acuminate to

acute, strongly conduplicate spathe, its margins free or fused basally. Flowers several, perfect, zygomorphic. Sepals 3, ovate, equal. Petals 3, unequal, clawed, the upper 2 broadly ovate to suborbiculate, the lower 1 oblong. Stamens 3, dimorphic; staminodia 3. Ovary 2- or 3-locular; ovules 1 or 2 per locule. Fruit a capsule. Seeds rectangular to oblong. Base chromosome numbers 11, 14, 15. LECTOTYPE SPECIES: *C. communis* L. (Britton & Brown, Illus. Fl. No. U. S. & Canada. ed. 2. **1:** 457. 1913). (Named for Caspar Commelijn [also spelled Commelin], 1667/1668–1731, and Jan Commelijn, 1629–1692, Dutch botanists.[6]—DAYFLOWER.

Commelina, with some 250 species, is the largest genus in the family. The center of diversity for the genus is southern Asia, but there are also numerous representatives in tropical Africa and a lesser number in the Neotropics. There are five native species in the United States (four in the Southeast) and four introduced ones, all of which occur in the Southeast.

Commelina virginica L. ($2n$ = 30, 60; perennial; leaves broadly lanceolate; inflorescences terminal, 1 to several together; spathes oblong, the margins fused for the basal ⅓–½), occurs from Maryland, southern West Virginia, Kentucky, Illinois, and Missouri south to southern Florida and southern Texas; it is also found in the Neotropics. The apex of the leaf sheath bears reddish, uniseriate, multicellular trichomes 2–5 mm long, a feature that distinguishes this species from other native species of the genus in North America.

Commelina erecta L. ($2n$ = 60; perennial; inflorescences single, terminal and axillary; spathes orbiculate, the basal ⅓ of the margins fused), occurs from New Jersey to northern Illinois, southern Wisconsin, and Nebraska south to Florida, Texas, and Arizona. *Commelina erecta* is cytologically diverse in West Africa (Morton, 1967).

Commelina dianthifolia Delile (leaves linear; spathes long-attenuate, the margins free) occurs from western Texas, eastern Colorado, and Arizona south to El Salvador. Its long-attenuate spathes distinguish it from other New World species. The southern Asian *C. appendiculata* C. B. Clarke, which also has long-attenuate spathes, appears to be closely related.

Commelina gigas Small (perennial; weak stemmed, clambering; spathes oblong, the margins free) is endemic to the Lake Okeechobee area in Florida (Wunderlin). The plants have a few white trichomes 1–2 mm long at the apex of the leaf sheaths.

Commelina communis L. ($2n$ = 48, 90; annual; leaves 15–40 mm wide; spathes oblong (orbiculate when spread out and pressed flat), acute, the margins free) occurs spontaneously in an area from southwestern Maine, southern New Hampshire, southwestern Quebec (vicinity of Montreal), southwestern Ontario, central Michigan, southern Minnesota, and Nebraska south to Georgia, northern Mississippi, and northeastern Texas. Pennell believed it to be native

[6]"*Commelina* has flowers with three petals, two of which are showy, while the third is not conspicuous: from the two botanists called Commelin: for the third died before accomplishing anything in botany." Linnaeus, Crit. Bot. (transl. A. Hort), 62, 63. 1737. The third Commelin was Caspar, Jr., 1700–1734, son of Caspar Commelin. "Actually *Commelina* was coined by Plumier, who was probably not aware of the existence of Caspar, Jr." (Wijnands, pp. 10, 11).

to eastern North America, while Brashier thought it was introduced from Asia. It is occasionally cultivated in the eastern United States (Bailey *et al.*). There are two varieties: var. *communis* (petals light blue, anthers entirely yellow) occupies the entire range of the species in North America; var. *ludens* (Miq.) C. B. Clarke (*C. communis* subsp. *ludens* (Miq.) Penn.; petals intense violet, anther connective with purplish brown eye spot) occurs from New England to Kentucky southward to Virginia. Both varieties are also present in eastern Asia. The smut *Ustilago commelinae* (Komarov) Zundel (*Tilletia commelinae* Komarov) infects var. *ludens*, but not var. *communis*, even when the two varieties are found growing together.[7] *Ustilago commelinae* is also known to parasitize *C. communis* (variety unknown) in China, Japan, and the eastern Soviet Union. The restriction of the smut to one of the two varieties of *C. communis* in eastern North America suggests a biochemical difference between the varieties, emphasizing their taxonomic significance.

Commelina diffusa Burman f. (*C. caroliniana* Walter) ($2n = 28, 30, 56, 60, 72$; annual; leaves 9–15 mm wide; spathes oblong when flattened, acuminate, the margins free) is a pantropic and warm-temperate species found in North America from Maryland, southern Ohio, northern Illinois, and eastern Kansas south to southern Florida and southern Texas. It has prostrate stems and erect flowering shoots. Japanese populations are $2n = 72$ (Fujishima, 1984). The west African *C. diffusa* var. *aquatica* (Morton) Morton, $2n = 28$, grows in shallow water in seasonally inundated grasslands.

Commelina nigritiana Bentham var. *gambiae* (C. B. Clarke) Brenan is native to West Africa and a recent adventive in central Florida (Manatee Co., *Wunderlin 5721*, USF; Polk Co., *Wunderlin & Beckner 9096*, USF). Its flowers are peach colored; the spathe is fused for the basal half along the margin and bears long white trichomes on the abaxial surface.

Commelina benghalensis L., $2n = 22, 28, 44, 56$, is an important weed in the croplands of tropical Africa and Asia. A recent adventive in the Southeast, it was first noted in southeastern Georgia in 1966 (Duncan) and has since been reported from central and western Florida. It has broadly ellipsoid, distinctly petiolate leaves with reddish trichomes at the apex of the sheath. The spathe margins are fused for the basal third of their length. The plants bear both chasmogamous and cleistogamous flowers. Seeds from the former weigh about one seventh as much as those from the latter (see Wilson for illustrations of both kinds of seeds).

Dormant seeds that are able to germinate far below ground, easy vegetative reproduction from fragments, and resistance to weeding are features accounting for the spread and abundance this species. Mechanical cultivation breaks up the plants. Fragments of stems can root in wet weather, reestablishing the population; they are able to sprout even if buried beneath 2 cm of soil. Seeds are dormant when freshly shed. After disruption of the seed coat by scarification or pricking, 40–70 percent of treated seeds germinate in 20 days (Budd *et al.*). The larger seeds from cleistogamous flowers are able to germinate if covered

[7]Data on smut parasites kindly provided by Clark T. Rogerson (New York Botanical Garden), based on unpublished observations by him and the late Stanley J. Smith (New York State Museum).

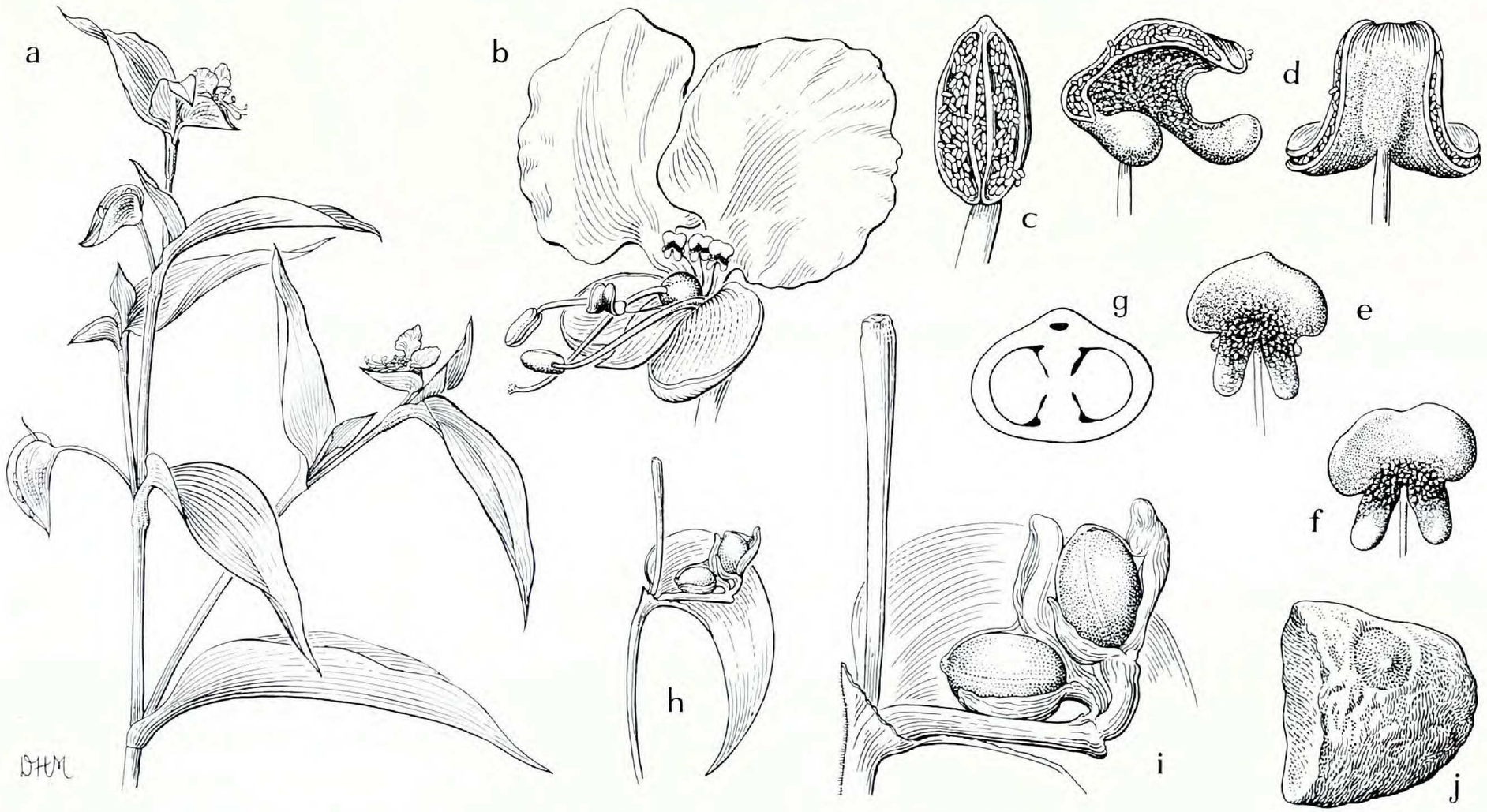

FIGURE 2. *Commelina communis* var. *communis*: a, stem with flowers and fruits, × ½; b, flower, showing 2 sepals, 2 conspicuous petals, reduced petal (below), 3 fertile stamens, and 3 staminodia, × 3; c, 1 of the 2 isomorphic fertile stamens, × 10; d, 2 views of anisomorphic fertile stamen, × 10; e, staminodium with rudimentary anthers, × 10; f, staminodium, completely sterile, × 10; g, diagrammatic transverse cross section of ovary at anthesis, showing 3 locules (2 fertile, each with 1 ovule; 1 sterile), × 15; h, infructescence with 2 capsules, 1 side of folded spathe removed, × 1; i, detail of same, × 3; j, seed, showing operculum, × 20.

by less than 14 cm of soil; the smaller seeds from open flowers, only if covered by less than 7 cm. In a natural population, 88 percent of the seedlings came from large seeds.

Another introduced species in the Southeast is *Commelina Forskalaei* Vahl, known only from southern Florida (Dade County, *D. S. Correll & Popenoe 51166*, USF, and *H. B. Correll, Popenoe, & Sanders 54190*, USF). It is distinguished from other species in our area by its undulate leaf margins. The spathes are orbiculate, and the margins are fused for the basal third. Like *C. benghalensis*, it also produces cleistogamous flowers on short subterranean shoots. In West Africa, where it is native, some plants have both perfect and staminate flowers (Morton, 1967).

Morton (1967) has provided much information on the biosystematics of the genus in West Africa. *Commelina ascendens* Morton, $2n = 28$, is a scrambling herb with the leaves and stems covered with uncinate hairs. The main stems are procumbent, and the erect branches bear inflorescences. *Commelina zambesiaca* C. B. Clarke, $2n =$ ca. 56, has leaf blades that are asymmetric at the base. *Commelina africana* L., $2n = 28$ (30), has yellow flowers. As a generalization, the polyploid West African taxa of *Commelina* occur at higher elevations and in moister habitats than the diploids.

Barnes, in an excellent account of floral biology of the southern Indian species, documented a diversity of phenological types in the genus. The opening and pollination of flowers in a cyme affect the flower type and maturation of remaining flower buds. In general, if early flowers of a cyme are pollinated and set seed, the remaining flower buds develop stamens only. If the buds or earlier flowers are removed, the later buds may develop ovaries and stamens. There is a developmental interdependence among the flowers of an inflorescence that probably is mediated by as-yet-undetermined plant growth substances.

Barnes also described anthesis and self-pollination. After the flower has been open for a few hours, the filaments coil, bringing the anthers into contact with the stigma and effecting self-pollination, as in *Commelina clavata* C. B. Clarke and *C. attenuata* Koenig, $2n = 48$. In *C. hirsuta* C. B. Clarke, the filaments coil, but not enough to bring the anthers into contact with the stigmas. Neither style nor filaments coil in *C. indehiscens* E. Barnes, and no selfing occurs. Selfing occurs before coiling in *C. tricolor* E. Barnes, where the anthers are very close to the stigma at anthesis. In *C. Kurzii* C. B. Clarke and *C. undulata* R. Br., both the style and the filaments coil two to three times, bringing about effective selfing. In *C. Forskalaei* the filament of the median stamen bends slightly, while the style coils strongly, bringing it into contact with the stigma and effecting self-pollination.

Owens tested 13 species of *Commelina* (including *C. benghalensis, C. diffusa,* and *C. erecta* from the Southeast) and found that all were self-compatible.

Faden has investigated the floral biology of *Commelina erecta* in eastern Texas. As in the Indian species, both perfect and staminate flowers are produced in the same cyme. Perfect flowers are produced first, and if seed set occurs, later flowers are staminate. Little selfing occurs.

REFERENCES:

Under family references see BAILEY *et al.*; FADEN & HUNT; MORTON (1967); OWENS; RADFORD *et al.*; WILSON; and WUNDERLIN.

BARANOV, A. I. A contribution to the knowledge of the life history of *Commelina communis*. Quart. Jour. Taiwan Mus. **17:** 81–113. 1964. [Illustrations.]

BARNES, E. Some observations on South Indian commelinas; two new species of *Commelina* from South India. Jour. Bombay Nat. Hist. Soc. **46:** 70–89. 1946. [Illustrations.]

BATES, J. C. Seed germination and development of the seedling of *Commelina virginica*. Trans. Kansas Acad. Sci. **42:** 109–112. 1939.

BERGER, C. A., A. L. LAFLEUR, & E. R. WITKUS. Mitosis in *Commelina communis* L. Jour. Hered. **43:** 243–247. 1942.

BRASHIER, C. K. A revision of the genus *Commelina* (Plum.) L. in the U. S. A. Bull. Torrey Bot. Club **93:** 1–19. 1966. [Four species; *C. gigas* omitted.]

BUDD, G. D., P. E. L. THOMAS, & J. C. S. ALLISON. Vegetative regeneration, depth of germination, and seed dormancy in *Commelina benghalensis* L. Rhodesian Jour. Agr. Res. **17:** 151–153. 1979.

DUNCAN, W. H. *Commelina benghalensis*, a species new to the United States. Brittonia **19:** 282. 1967.

FADEN, R. B. Reproductive biology of *Commelina erecta* L. (Commelinaceae) in eastern Texas. (Abstract.) Am. Jour. Bot. **72:** 953. 1985.

FASSETT, N. C. Another driftless area endemic (*Commelina erecta* var. *Greenei*, var. nov.). Bull. Torrey Bot. Club **70:** 398, 399. 1943.

FUJISHIMA, H. Karyological studies on Commelinaceae. VI. Chromosome numbers in *Commelina communis* complex and their geographical distribution in Japan. Kromosomo **21/22:** 605–610. 1981.

———. VII. Karyotypes of *Commelina auriculata* and *C. diffusa* from Japan. Jour. Fac. Educ. Tottori Univ. Nat. Sci. **33:** 35–44. 1984.

FUKUMOTO, K. Examination of chromosome numbers and karyotypes in the genus *Commelina*. II. Intraspecific variation of the chromosome numbers in *Commelina communis* L. Kromosomo, II. **13:** 350–354. 1979.

HSU, K. S. Seed morphology and seed germination of genus *Commelina* in Taiwan. Quart. Jour. Chin. Forest. **5:** 55–60. 1971.

LEWIS, W. H., H. L. STRIPLING, & R. G. ROSS. Chromosome numbers for some angiosperms of the southern United States and Mexico. Rhodora **64:** 147–161. 1962.

MACKEEVER, F. C. A variegated foliage form of *Commelina*. Rhodora **63:** 88–90. 1961. [*C. communis*, from northern New Jersey.]

MAHESHWARI, S. C., & B. BALDEV. A contribution to the morphology and embryology of *Commelina Forskalaei* Vahl. Phytomorphology **8:** 277–298. 1958.

——— & J. K. MAHESHWARI. Floral dimorphism in *Commelina Forskalaei* L. and *C. benghalensis* L. Phytomorphology **5:** 413–422. 1955.

——— & B. SINGH. A preliminary note on the morphology of the aerial and underground flowers of *Commelina benghalensis* Linn. Curr. Sci. Bangalore **3:** 158–160. 1934.

MALLOCH, K. R., & R. FENTON. Reversible effects of farnesol on *Commelina communis* L. New Phytol. **88:** 249–254. 1981. [Stomatal closure.]

MCLAIN, D. D. The cytology and taxonomy of *Ustilago commelinae*. Diss. Abstr. **21**(5): 1033. 1960.

MITSUI, S., K. HAYASHI, & S. HATTORI. Crystallization and properties of commelinin, a blue metallo-anthocyanin from *Commelina*. (In Japanese.) Bot. Mag. Tokyo **72:** 325–333. 1959a.

———, ———, & ———. Further studies on commelinin, a crystalline blue metallo-

anthocyanin from the flowers of *Commelina*; studies on anthocyanins XXXI. Proc. Japan Acad. **35:** 169–174. 1959b.

MORTON, J. K. Cytotaxonomic studies on the Gold Coast species of the genus *Commelina* Linn. Jour. Linn. Soc. Bot. **55:** 507–531. 1956.

PENNELL, F. W. The genus *Commelina* (Plumier) L. in the United States. Bull. Torrey Bot. Club **43:** 96–111. 1916. [Four species.]

SAXE, H. A structural and functional study of the coordinated reactions of individual *Commelina communis* L. stomata (Commelinaceae). Am. Jour. Bot. **66:** 1044–1052. 1979.

SMITH, R. J., JR. Competition of spreading dayflower (*Commelina diffusa*) with rice (*Oryza sativa*). Weed Sci. **32:** 116–119. 1984.

SOUÈGES, R. Embryogénie des Commelinacées; développement de l'embryon chez le *Commelina communis* L. Compt. Rend. Acad. Sci. Paris **246**(14): 2082–2086. 1958.

UPHOF, J. C. T. Vergleichende Blütenmorphologie und blütenbiologische Studien an *Commelina virginica* L. Ber. Deutsch. Bot. Ges. **52:** 173–180. 1934.

TROCHAIN, J. Sur la biologie de deux Commelinacées (*Commelina Forskalaei* Vahl et *C. benghalensis* Linn.). Compt. Rend. Acad. Sci. Colon. **194:** 743–745. 1932.

WALKER, S. R., & J. P. EVENSON. Biology of *Commelina benghalensis* in southeastern Queensland, Australia. 1. Growth, development, and seed production. Weed Res. **25:** 239–244. 1985; 2. Seed dormancy, germination, and emergence. *Ibid.* 245–250.

WIJNANDS, D. O. The botany of the Commelins. viii + 232 pp. *64 pls.* Rotterdam. 1983.